GAS JOURNAL

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STEEL v. CAST IRON

THERE is much controversy at the moment concerning the allocation of raw materials to the steel industry and to the cast iron industry—*i.e.*, the ironfounders, and from both angles there has already appeared considerable correspondence in the national and the technical Press. The matter was referred to in the *Journal* last week and in the same issue we published a letter strongly advocating the greater use of sheet steel for the manufacture of gas cookers, the argument being put forward that the wider use of sheet steel would automatically result in a direct and substantial saving of metal and the multiples of materials and coal to make that metal. Added to this would be savings in freight and handling costs. On a later page today (p. 352) we give an address by Mr. G. E. Currier on the gas supply position in the North East—a most interesting address in which comment is made on the progress of the new works at Tingley. The first unit of 7 mill. cu.ft. per day will be ready to go into commission this year. Unfortunately, the unit will be restricted to about 60% of its production capacity for 12 to 18 months because of the delays in the delivery of cast iron pipes required to take the gas into the West Yorkshire grid. This puts another aspect on the picture and is one example only of what can be termed the cast iron bottleneck. We need more steel; we also need more cast iron.

On Thursday last a reply to criticisms that the excess use of raw materials by the iron foundry industry was responsible for the failure of the steel industry to reach a production target in 1951 of 16 mill. tons was made at a Press conference in London by Mr. N. P. Newman, Chairman of the Council of Ironfoundry Associations. Iron foundries had been blamed, he said, for using more than their fair share of the raw materials of pig iron and scrap. The British Iron and Steel Federation—and he emphasised that this body does not represent the foundries making cast iron products, that the 'Iron' of the title means only iron for steelmaking—had not only made this charge but had suggested that iron foundry output should be limited in 1952 to the 1950 level of 3,500,000 tons. Iron foundries denied the right of the steel industry to attempt to define the rate of this expansion. And the dispute which has arisen between the Ironfoundry Associations and the Federation was not a domestic affair. It was a matter of national concern that the difference of opinion between the two industries should be sensibly resolved. Mr. Newman argued that an attempt to substitute sheet steel for iron castings on a large scale would cause acute dislocation in both the sheet fabricating industry and the iron foundry industry. Again, the Chancellor of the Exchequer has made it clear that the use of steel for many articles in this country is to be drastically reduced. How can suggestions for substitution be carried into effect? We feel that the logical way out of the present dispute of cast iron *versus* steel is for the Minister of Supply to intervene. It is for him, not the steel industry, to allocate raw materials to the iron foundry industry and to give decision on the rate of output of the industry for 1952.

A TECHNICAL MORALITY

A YEAR ago, under the title 'Meeting or Marathon,' we ventured to preach a small sermon on the verbosity and other failings to be found among authors of papers. We were reminded of this at an extraordinary meeting of the Illuminating Engineering Society on January 23, when the Papers Committee of that body presented 'Papier Maché,' a technical morality in six morals. The procedure in the preparation of a paper was shown, by means of a series of sketches, from the time the manuscript was received until it was presented and published. The work of the Papers Committee, the referees and the Hon. Editor, and how to—and how not to—deliver a paper were dealt with. That this enjoyable piece of nonsense, ably written and performed by members, should have been chosen as the 'business' of a meeting does, we suggest, reflect credit on what may with truth be termed a learned society.

One by one, the faults that threaten to send the editor of a technical journal to an early grave were given an airing and the morals pressed home: The papers typed with single spacing, thus leaving no room for editorial correction; the papers typed on both sides of a sheet, of which only one copy is submitted; the papers with the unnecessary historical introduction, massed appendices, and endless calculations where only the conclusions are required; the papers with graphs that require re-drawing and so many illustrations that the engraver's bill threatens financial ruin. They were all there—even the old saying that photographs sent through the post should leave the sender as he himself hopes to leave this earth, stiff, flat and correctly labelled!

Not content with criticising the papers themselves, the performers directed an unkind spotlight on some common weaknesses in presentation—the dropped notes, the muddled slides, the coy witticisms that do not come off, and so on. It remains to be seen whether this good-natured protest will have any effect. Quite possibly the members of the I.E.S., having laughed heartily, will go away and do the same thing over again. For it is a common failing to think that such remarks are directed only at the other fellow.

We do not want to exhume our earlier remarks on the subject of technical meetings and papers, but we are tempted to put forward one or two quite serious suggestions. First, a word about difficulties of hearing. The speaker who mumbles, has a weak voice, or poor enunciation is a trial. If mechanical amplification or some form of sounding board or megaphone is impracticable, could not some method be devised whereby listeners at the back of the hall can *silently* indicate when the speaker is becoming inaudible? The usual plaintive cry of 'Can you speak louder please?' is usually rewarded with only a momentary effort, the speaker soon lapsing into his former mumbling. Would he not be more likely to sustain his effort if, say, a red and green light at the back of the hall (or even on his lectern) were employed, the green signifying satisfactory conditions, and the red, unsatisfactory.

While it is better, in the case of a long paper, to provide copies of the full work and read only an abstract of it, it is better still to try to limit the whole paper to such a length as can be read within the space of an hour at the most. Brevity, which is so much a part of modern journalism and advertising, is a lost art as far as technical papers are concerned. Contrary to what appears to be popular belief, quantity is no criterion of quality. And this emphasis on brevity must not be limited to the author; it applies no less to those taking part in the discussion who should adhere to the time limit suggested by the chairman at any particular meeting. Certainly at meetings of the Institution of Gas Engineers speakers show scant courtesy in this respect—a notable instance being provided by the autumn research meeting last November. Determined to shoot-off their set pieces of lengthy manuscript the situation and atmosphere at several discussion sessions was ill-mannered and exasperating. That manuscripts of speakers dealing with abstruse and highly technical subjects should be available to the Press is another matter. All these points are important, not only to the average member of an association but to the Technical Press. By helping the Press to do its job properly, the member is himself helped. It is as simple as that.

HIRE PURCHASE CONTROL

AN Order was made by the Board of Trade last week restricting the terms for the initial deposit and the repayment period in certain hire-purchase and credit sale agreements. The goods affected include space heaters and water heaters, washing machines, and refrigerators. Cookers are not included in the goods listed. The Order fixes the minimum initial deposits at 33⅓% and 18 months as the maximum period within which the balance of the price must be paid. The Order came into force on February 1.

THE ECONOMIC SITUATION—

COMMENTING on the Chancellor of the Exchequer's statement in the House of Commons on the economic crisis the *Financial Times* said 'If Mr. Butler's Budget is to complete the pattern of the plan as it has so far been revealed it can hardly be anything but tough.' The Chancellor's announcements included a reduction of home supplies of plant, machinery, and vehicles of between £150 mill. and £200 mill. on 1950 and restrictions on metal household goods; an Order (referred to in another note) to restrict hire-purchase on various appliances, further import cuts of £150 mill., and the exceptional move of bringing forward the Budget to March 4, about six weeks ahead of the normal date. The only real surprise in the statement was the advancement of Budget day. Massive cuts in supply of goods must be matched by similar reduction in the supply of money, and what Mr. Butler proposed can be brought to logical conclusion only by the Budget. In deciding to restrict hire-purchase business the Government has closed an obvious gap in its defences against inflation. Previously the controls on this type of trade were negligible; the new controls are similar to those in force in the United States. It is to be noted that the new restriction does not apply to cookers. In the latest accounts of the Gas Council there is an item of just under £19 mill. for hire-purchase and deferred payment accounts, an increase of £8.5 mill. over the previous year. Most of this amount is in respect of cookers; over 373,000 obsolete cookers were replaced in the year ended last March, most of them on hire-purchase terms. The restriction does, however, apply to space heaters, water heaters, and refrigerators, sales of which are already restricted by the incidence of purchase tax.

—AND THE BUDGET

REPRESENTATIONS on the 1952 Budget from the Federation of British Industries were published before the Chancellor made his statement on the day that Parliament reassembled. Some of the points raised by the Federation were dealt with by Mr. Butler, but the fact remains that industry holds the view that high taxation hits the will to work and that the introduction of an excess profits tax is likely to do serious and long term harm to British industry. In the long term, the country's economy can be saved only by increased production. The switch from peace to defence will actually tend to reduce productivity; moreover increased production is at present limited by the supply of raw materials and fuel. It is clear, there-

fore, that in the coming fiscal year the greater contribution to the defence programme must come from cuts in other forms of expenditure. In the opinion of the Federation the major cuts in the allocation of the nation's resources should be made in Government expenditure on both current and capital account and in current private consumption. The Federation welcomes the return to a more realistic monetary policy which will, however, be frustrated if it is accompanied by taxation on industrial profits and capital which removes the reward of savings at the source and eats into the capital invested in industry. It is the considered view of the Federation that the country's economic problems, both internal and external, cannot be solved unless there is a drastic and fearless cut in Government expenditure accompanied as soon as possible by a reduction in the general burden of taxation. The statement sets out in detail the Federation's objections to excess profits tax and reiterates its hope that in the light of such objections if the Government decides to seek some method of limiting any fortuitous excess profits it will do so by means other than the imposition of an excess profits tax on the lines of the tax which was in operation during the war. On purchase tax the Federation emphasises that the exporting ability of many industries is being seriously affected by the way in which purchase tax operates.

GAS SERVICE CONFERENCE

ARRANGEMENTS are almost complete for the Gas Service Conference, to be held on March 11, 12 and 13. The organisation of this, the largest sales conference ever to be held in the gas industry, is no mean feat—the more so as the whole planning and detailed work involved has fallen upon only two or three people. We wonder if visiting delegates will realise how much effort is required to arrange a three-day gathering of this type, particularly one with so compressed a programme. For example, will they appreciate that the 1,100 acceptances received necessitate 13 separate entries in records—a total of over 14,000—and that collating sets of tickets for functions and sessions represents over 5,000 separate tickets? With hotel accommodation to be reserved for 300 delegates, and the attendant problems of catering, transport, and printing, all this means a great deal of work. No doubt delegates will wish to lighten this load as much as possible, and there is one simple way in which they can render the greatest assistance to the organisers. It is to address *all* correspondence concerning the conference to Mr. R. J. Gregg, the Conference Organiser, at Gas Industry House. In matters of this nature, 'short cuts' in correspondence are apt to traverse the most circuitous route.

TRIAL BY JURY

SINCE its inauguration three years ago as a unified organisation of sellers of coke in place of the two pre-war circles separately comprising producers and distributors, the London and Counties Coke Sales Circle has shown resource and variety in its efforts to retain the interest of its members. Its latest production was a 'trial by jury' at the Holborn Restaurant on January 29, presided over by Mr. Justice (Dr.) F. J. Eaton, Chairman of the Circle, with Mr. R. S. Hopper as Clerk of the Court and six cases for trial, of which only three could be dealt with in the available time. The indictments were (1) that a producer had declared that a gas board was able to give better service than a distributor; (2) that a distributor had given succour to the (electricity) enemy by supplying coke breeze to power stations; and (3) that a distributor had exhorted depôts to encourage the sale of solid fuels other than coke. Our own verdict was that the trial did not owe much of its success either to the eloquence of those taking the principal parts or to the cleverness of the acting, but that it provided several of the best known members of the Circle with an excellent opportunity—a privileged occasion—for saying candid things about coke sales which might well have been ruled out of order at an ordinary meeting. These are difficult days for coke salesmen, who have both short and long term problems to face at a time when all fuels are scarce and it is not easy to maintain a steady balance between markets, and the real success of the 'trial' lay in the candour with which the various characters spoke. The attendance was large, probably larger than could have been comfortably accommodated at Gas Industry House even if a room had been available, and the Circle agreed to meet again at the same venue.

SOUTHERN ENTERPRISE

THE Southern Gas Board is having a full share of publicity in the storm raging around the proposed extension of the works at Oxford. It is pleasant to turn to items of interest in less controversial spheres. A fortnight ago we wrote at some length of the Board's pioneer work in Hampshire in the distribution and application on a commercial scale of gas liquor as an agricultural fertiliser. Today we record two further examples of enterprise in the southern counties. One is an illustrated account of the transformation which has been effected on the ground floor of the fine Georgian showroom building at Poole—a name, incidentally, long synonymous with all that is progressive on the production side of the industry. Here, local craftsmen have succeeded in undoing the depredations of generations of distemper-applying vandals and have restored to their former beauty intricate friezes and finely carved fireplaces. They have created a demonstration theatre as modern as the hour and yet in keeping with the dignity of the past.

In another direction—but also on the service side—the Southern Board has shown a degree of enterprise which is altogether commendable in these days of coke shortage. It is the designing and equipping of a motor vehicle specially for promoting the sale of coke and coke appliances. On a later page we describe in detail and illustrate this interesting vehicle, which during the 1951 season travelled upwards of 2,000 miles to bring the story of coke efficiency to over 30 different places throughout the area of supply. We may mention that the exhibition vehicle is readily adaptable for the display of gas appliances if desired and embodies a 'live' fireplace properly flued and insulated. Here is an excellent idea for the local show where the time and expense involved in setting up a 'permanent' stand is not warranted.

A FITTING MEMORIAL

THE name of John Stewart Dow was for nearly four decades synonymous with illuminating engineering and public lighting progress. From its foundation in 1909 until his death in 1948 he was closely connected with the Illuminating Engineering Society, first as Hon. Assistant Secretary and from 1928 as Hon. Secretary until he became President in 1946. He was also Hon. Secretary of the Association of Public Lighting Engineers from 1931 till the end of 1935. During the whole of the 39 years he was associated with the former body he never missed a Council meeting. His keen interest in the training of students and in the encouragement of collaboration between lighting engineers and architects has found fitting

commemoration in the Dow Memorial Prize, details of which have just been announced by the I.E.S.

In virtue of a bequest by Mr. Dow the Society is offering a prize, valued at £75, which will be awarded for a competition intended for students of illuminating engineering or those branches of engineering concerned with illumination, and students in other fields in which applied lighting plays an important part. While entries from individuals are not excluded, the competition is primarily intended for students working in collaboration. Along with the cash award a certificate will be presented to each member of the winning team, while certificates of merit will be awarded to any other entries of outstanding merit. The subject for the 1952 competition is the layout, artificial lighting, and decoration of a ground floor showroom. Full details and forms of application may be obtained from the I.E.S., 32, Victoria Street, S.W.1, and candidates must have been born on or after April 1, 1926.

Personal

Mr. W. R. Branson, Planning Engineer to the Wales Gas Board, left the service of the Board at the end of 1951 to take up an appointment with the East Midlands Gas Board.

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Mr. G. P. Belsham has been appointed a Joint Managing Director of Brookhirst Switchgear, Ltd., of which Company he has been a Director since 1948, and **Mr. K. N. Swash,** B.SC., A.M.I.E.E., has been appointed a Director. Mr. Swash has been Chief Engineer since 1948.

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The North Thames Gas Board has announced the following appointments: **Dr F. G. Holman** to be Chief Medical Officer; **Dr. W. Gunn,** Medical Officer, Eastern Area; **Mr. A. F. Grant,** Station Engineer, Bow Common; **Mr. P. D. Whitestone,** Deputy Station Engineer, Southall; **Mr. A. E. Tyrrell,** Chief Industrial Representative; and **Mr. S. A. Tennant,** Local Manager, North Middlesex District.

Obituary

Mr. Lionel Abrahams, who was until nationalisation Director and Secretary of St. Neots Gas and Coke Company, and who had for many years been a solicitor in practice at St. Neots, died on January 22.

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Mr. H H. Creasey, who retired in 1937 from the position of Deputy Controller of Gas Sales to the Gas Light and Coke Company, died at his home at Winchmore Hill on February 1, aged 80 years. He had a long and distinguished record of service not only in the employ of the Company but in the wider interests of gas service. He joined the Gas Light and Coke Company in 1890, and four years later was appointed Staff Officer in the Inspectors' Department. In 1903 Mr. F. W. (later Sir Francis) Goodenough was appointed Chief Inspector and so began the sales and service organisation which was in 1910 named the gas sales department. From the beginning Mr. Creasey took a leading part in nearly every development which characterised the growth of the department. He was particularly concerned with the pioneer work of making 'gas-minded' doctors and other professional classes whose favourable opinion of gas service was influential. So successful were his efforts in these directions that he became known as 'Dr.' Creasey. He was a firm believer in the systematic maintenance of gas appliances. In 1923 he was appointed Manager of the sales development section, later the special service section and now known as the Headquarters Section. Ten years later he was appointed Deputy Controller of Gas Sales, a post he filled with success until his retirement. He delivered many lectures to gas and other organisations. He was a founder member of the London and Southern Junior Gas Association, to which organisation he presented a paper in 1909 on maintenance. He also read a paper at the first conference of the British Commercial Gas Association on 'The Campaign Among the Doctors,' and in 1926 at a similar conference he gave an outstanding address on 'The Commercial Value of a Census of Gas Appliances.'

Diary

Feb. 7.—Chemical Engineering Group (S.C.I.): Joint Meeting with Nottingham Section, S.C.I.: 'Extraction and Utilisation of Methane from Coal Measures,' Dr. D. W. Gillings.

Feb. 8.—Scottish Juniors (Western): Paper by R. A. Currie (Glasgow). Royal Technical College, Glasgow

Feb. 8.—Midland Section, I.G.E.: Discussion on Report of the Sub-Committee on Unaccounted-for Gas (I.G.E. Comm. 380), to be opened by H. J. Escreet, Chairman of Sub-Committee. Grand Hotel, Birmingham, 2.30 p.m.

Feb. 9.—Scottish Juniors (Eastern): Short paper meeting. Edinburgh.

Feb. 9.—Western Juniors: Visit to Exmouth works; 'Psychology and Plant Operation,' H. C. Widlake (Plymouth).

Feb. 13—London and Southern Juniors: Evening visits: (a) Nevill's Bakeries, Acton; (b) Kemsley Newspapers, Ltd., Kemsley House, W.C.1.

Feb. 16.—Yorkshire Juniors: 'Gasworks Effluents,' W. H. Blackburn, PH.D., M.SC., Research Chemist to Joint Research Committee of Gas Research Board and Leeds University. At Leeds University.

Feb. 19.—Institute of Fuel: 'An Investigation of Whole House Heating,' F. C. Lant, A.M.I.H.V.E., and J. C. Weston, PH.D., M.I.H.V.E., Institution of Mechanical Engineers, Storey's Gate, S.W.1. 5.30 p.m.

Feb. 19.—London and Southern Section, I.G.E.: 'The Consumer and the Gas Industry in a World of Changing Standards,' Professor D. M. Newitt (Past President, Institution of Chemical Engineers), 17, Grosvenor Crescent, 2.30 p.m.

Feb. 20.—Wales Juniors (North): Shotton. Visit to spent oxide treating plant of J. Summers.

Feb. 21.—Midland Juniors: Half-day visit to Humber, Ltd., Coventry.

Feb. 21.—London and Southern Juniors: Visit to Thomas De La Rue & Co., Ltd., Cavendish Works, Wandsworth, 2.30 p.m.

Feb. 21.—Institute of Sewage Purification (Metropolitan Division): Paper by Philip Wedgwood (Eastern Gas Board), Friends House, Euston Road, London, 6.30 p.m.

Feb. 23.—Manchester Juniors: Annual Dinner. Manchester.

Feb. 28.—Society of Chemical Industry (Yorkshire Section): Joint meeting with Leeds University Chemical Engineering Society: Hodsman Memorial Lecture, A. C. Monkhouse, B.SC., PH.D., F.R.I.C.

Feb. 28.—North Thames G.C.C.: Westminster City Hall, Charing Cross Road, 2.30 p.m.

Mar. 1.—Midland Juniors: Annual Dinner, Imperial Hotel, Birmingham.

Mar. 3-29.—Ideal Home Exhibition, Olympia. Gas Council stand No. 67, Grand Hall.

Mar. 4.—East Midland G.C.C.: Victoria Station Hotel, Nottingham, 11.30 a.m.

Mar. 4.—Midland Juniors: 'The Equipment of Combustion Safeguard Equipment,' J. Price (Coventry). At Birmingham.

Mar. 7.—London and Southern Juniors: 'Twenty Years of Development in West Kent,' F. T. Buist (South Eastern). 178, Edgware Road, 6.30 p.m.

Mar. 8.—Scottish Juniors: Joint meeting of Eastern and Western Districts; paper by J. T. Haynes, Junior Vice-President, Institution of Gas Engineers. Glasgow, 3 p.m.

Mar. 11-13.—Gas Service Conference. Seymour Hall, W.1. (For full programme see *Journal* of January 16, p. 159.)

Mar. 12.—London and Southern Juniors: Visit to Lewis Berger works, Homerton. 2 p.m.

Mar. 12.—Yorkshire Juniors: President's Day. Visit to Drakes, Ltd., Halifax.

DISTINGUISHED LONG SERVICE RECORDS

DURING the past few months 700 North Thames Gas Board employees, who have completed 40 years or more in the service of the Board, have been presented with long service awards by the Board's Chairman, Mr. M. Milne-Watson.

Among those who have received an award is Mr. E. J. Caudwell, a plant attendant at Bow Common. Mr. Caudwell has a distinguished record in public service in addition to his service with the Board and its predecessors, as the following list of activities will indicate: Member of the Poplar Borough Council for 19 years; Bow Consolidated Charities Committee for six years; County of London Licensing Committee for four years; Poplar Labour Exchange Committee for five years; Poplar Youth Employment Committee for three years; L.C.C. School Managers' Committee for seven years, and Former Public Assistance Committee for 10 years.

His gas interests extended to the following committees: Gas Light District Co-Partnership for 17 years; War Memorial Fund for 18 years; Works for 28 years; Awards for two years; Editorial Advisory for four years; Benefit Society for three years; and Trustee of G.L. & C.C. Pension Fund for 10 years.

Mr. Caudwell received an engraved gold wrist watch and congratulations from Mr. Milne-Watson.

For the first time on record a woman employee received an award. She is Mrs. E. K. Walker, employed by the Board as a caretaker at Maidenhead. She joined the Maidenhead Gas Company in 1911 at a wage of 6s. a week in addition to accommodation. Her husband was employed by the same Company until his death in 1943. Mrs. Walker is vice-chairman of the local branch of the British Legion (Women's Section). She was presented with savings certificates.

John W. Johnson, William Brown, and Arthur Livermore, of the storekeeping staff of the Board's Hanwell stores, are the first winners of the competition for the 'best-kept depôt store' in the area. The competition, which is to be an annual one, is run on a group basis initially and the prize winners from each of the eight groups competed for the distinction of maintaining the best kept depôt store.

The group winners were:—*Western Division,* Hanwell, Storekeeper J. W. Johnson; *North Western Division,* Stanmore, Storekeeper W. C. Howling; *Central Division,* Rathbone Street, Storekeeper A. Pusey; *Eastern Division,* Ripple Road, Storekeeper S. W. P. Bell; *South Western Division,* Windsor, Storekeeper E. Appleton; *Northern Division,* Stoke Newington, Storekeeper C. G. Wootton; *Romford and Southend Districts,* Billericay, Storekeeper A. E. Moore; and *Commercial, Hornsey and Lea Bridge Districts,* Lea Bridge, Storekeeper J. S. Alexander.

Mr. Milne-Watson, presenting individual cash awards and shields to the winners, remarked on the difficulty of judging the competition because the general standard was so high.

Gas Workers' Wages

It was announced on Monday that at a recent meeting of the National Joint Standing Committee for Intermediate Grades an increase of £20 per annum was granted to all scales as laid down in the national agreement for male intermediate grades employed in the gas industry. Of this increase 80% applies to the scales of female intermediate grade employees. The increase takes effect as from December 30, 1951.

De La Rue Superannuation

All employees of Thomas De La Rue & Co., Ltd., with five or more years' service will enjoy the benefits of a new non-contributory superannuation scheme.

The scheme applies to 3,000 men and women employed at Tynemouth, Warwick, Strathendry, the London factories at Wandsworth, S.W., Barretts Grove, N., Bunhill Row, E.C., Cricklewood, N.W., as well as to all office workers in London and Manchester.

The cost of the pensions plan will be borne entirely by the Company and it will apply to all employees with certain age limits. Pensions will be payable to men of 65 and women of 60. All eligible workers will also be insured against death in service.

De La Rue have also decided, by increasing the Company's contributions, to raise retirement pensions, and the sums assured, for executives on monthly salaries.

London and Southern Juniors Visit Meter Works

Right to Left.—The President (Mr. J. D. C. Woodall), Mr. C. A. Deas, Mr. J. E. Gray (Hon. Secretary), and Mr. D. G. Winslow in one of the meter shops at Cottage Lane.

A GATHERING of members of the London and Southern Junior Gas Association assembled at Parkinson and Cowan's Cottage Lane works on January 23 to be shown the assembly of gas meters and have an insight into the 'B.K.' vacuum governor and the infra-red drying equipment.

The Parkinson Stove Company demonstrated their 'Renown' cookers and radiators with working models; the Metropolitan Leather Company had diaphragms of all sizes on exhibition and the street lighting display was centred round the new 'Maxilla Festival' lantern; the Parkinson water heater was also on show.

Mr. R. J. Rogers (Director), speaking in place of Mr. C. H. Pearson, who had a prior engagement, welcomed the guests. Mr. J. D. C. Woodall (President, London and Southern Junior Gas Association) replied.

1952 'Journal' Directory

THE following changes have been notified since the 1952 edition of the *Gas Journal Calendar and Directory* went to press. To keep the current issue up to date readers are invited to note these alterations (together with the appropriate adjustments relating thereto in the Personnel section, pp. 141-156) in their own copies and to watch for further changes noted in the first *Journal* each month.

Page 26.—GAS COUNCIL: *Deputy Chairman:* H. F. H. Jones, M.B.E., M.A., A.M.I.C.E., M. INST.GAS E.

„ 29.—EAST MIDLANDS GAS BOARD: Delete *Chairman:* H. F. H. Jones.

„ 30.—DONCASTER: Delete D. T. Livesey, *Local M.* (retired).

„ 56.—BOW COMMON (North Thames): Delete F. R. Weston, *Station Engineer* (deceased).

„ 80.—SOUTH EASTERN GAS BOARD COAL AND SHIPPING DEPARTMENT: *Marine Superintendent:* R. Wilson, D.F.C., M.I.N.A., F.C.M.S., 34, Clayton Street West, Newcastle-upon-Tyne, 1. T/N 25762.

„ 112.—LLANDUDNO: Price should read 20.26d. per therm.

„ 129.—BANFF AND MACDUFF: Address: 77, High Street, Banff.

„ 173.—VICTORIA: B.C.: Sales 478 mill. cu.ft.; calorific value 469 B.Th.U.; consumers 9,061.

„ 187.—INSTITUTION OF CHEMICAL ENGINEERS: Delete C. J. T. Mackie, *Assistant Secretary* (deceased).

„ 214 and A15.—VERROLEC, LTD.: Removed to 27, Balfour House, Finsbury Pavement, Moorgate, London, E.C.2. T/N MONarch 6802. T/A Verrolec, Avenue, London,

„ A12.—RADIATION GROUP SALES LTD.: Head office T/A should read 'Radicentre' (not 'Degasco').

Attention is called to the omission of a multiplication sign on p. 246 of the *Handbook*. Under the heading 'Ammoniacal and Spent Liquor Oxygen Absorption Test' the formula for calculating oxygen absorption should read:

Forty millilitres $\times \frac{N}{80}$ permanganate solution consumed.

IN PARLIAMENT

Uncertified Electricity Meters

As a measure of light relief to the gloom spread by the Chancellor of the Exchequer's statement on the financial crisis, the House, on January 29, having taken in its stride the second reading of the Hydro-Electric Development (Scotland) Bill and the Metropolitan Police (Borrowing Powers) Bill, went on to debate the Electricity Supply (Meters) Bill.

In moving that this Bill be read a second time, Mr. L. W. JOYNSON-HICKS (Parliamentary Secretary to the Ministry of Fuel and Power) described it as a modest Bill as uncontroversial as it was brief. Following the precepts propounded earlier by the Chancellor, it was an economy measure designed to limit the immediate expenditure of capital investment. It also, we gather, has another not unimportant object—namely, to circumvent any repetition of a painful little episode which occurred once before when a particularly bright electricity consumer declined to pay his bill because he had not received his supply through a certified meter. The matter went before the Court, which found that the consumer was perfectly justified.

The story begins at the close of the last century with the Electric Lighting (Clauses) Act, Section 49 of which provided that the value of electricity to ordinary consumers was to be ascertained by a certified meter. The years passed and very few certified meters were provided, which was not really surprising because certified meters had to be provided by people who rejoiced in the name of 'electric inspectors' created by local authorities. In point of fact local authorities created scarcely any with the result that comparatively few meters became certified.

Following the painful episode recorded above, Parliament hastily passed the Electricity Supply (Meters) Act, 1936, which provided, among a number of other things, for the legalisation of the then existing meters even if they were uncertified; it made them legal until certified meters were installed or until July 1, 1948, whichever was the earlier. From that time certification proceeded normally and all new meters installed were certified. The war, however, postponed further certification, and during the war the procedure lapsed entirely. By the end of the war it was found impossible to catch up on the back-log, so the Government then in power introduced Section 52 into the Electricity Act, 1947, which extended the period of certification until June 30, 1953.

It has now been ascertained that of roughly 15½ mill. electric meters in the country some 4 mill. are still uncertified, the replacement of which within the time limit imposed by existing legislation would involve capital expenditure to the tune of £3½ mill., which is not considered a necessary and essential investment at the present juncture. The Bill was therefore intended to postpone the date until June 30, 1958. The average meter tends to run rather slow than fast with age, and, as the Parliamentary Secretary rather naively remarked, it is unlikely that consumers will have any objection whatever to the proposal that some of them will have to continue with uncertified meters for another five years.

North Thames Consultative Council

A REVIEW of salient points from the Board's report and accounts was given to the North Thames Gas Consultative Council at its meeting at the Caxton Hall, Westminster, on January 31, by Mr. O. W. Wells, the Board's Chief Accountant. In the unavoidable absence of the Chairman (Councillor Edwin Bayliss), the chair was taken by Councillor Mrs. W. KADER (Deputy Chairman).

Mr. Wells revealed that revenue from the sale of gas produced slightly more than half the Board's total income, while the next largest item was 'disposal of by-products' which accounted for approximately one-third. The year's surplus of £313,000 represented 0.73% of the gross revenue. Mr. Wells pointed out that the net assets, after deduction of current liabilities, were over £64 mill. and capital liabilities £61¼ mill., leaving a balance of some £2.3 mill. represented by reserves. The net surplus was equivalent to 0.2d. per therm sold, which all must agree was a very narrow margin.

In pre-nationalisation days it was the practice to use a substantial carry-forward to take care of temporary fluctuations which inevitably arose in a seasonal business; the present carry-forward of £469,000 could easily be eliminated in an unfavourable year. A total of £2.8 mill. had been borrowed temporarily from the Gas Council to meet current outgoings, and this amount, together with subsequent borrowings, would be converted into a liability to the Gas Council for British Gas Stock. Mr. Wells dealt briefly with a number of other points from the Board's accounts.

In the course of further business, the Council considered a suggestion that the Board should make available to consumers an instantaneous water heater of a size between that of the sink heater and the bath or multi-point type. The Board had pointed out, however, that any such heater would have to be fitted with a flue, which would materially increase installation costs. The Board did not favour the introduction of an intermediate size, and the Council endorsed this view.

A complaint was received through the Town Clerk of Romford from the local Residents' and Ratepayers' Association criticising the Board's policy of discontinuing the use of meter cards. This subject had been fully considered on a previous occasion, and it was pointed out that consumers who particularly wanted a meter card could still be supplied with one on request.

News in Brief

During December the North Eastern Gas Board's home service staff gave 64 cookery demonstrations to a total audience of 3,294.

During the Coldest Spell in the north east for five years, with a temperature of 19°F., gas consumption at Sunderland reached an all-time record of 10½ mill. cu.ft., 10% higher than the previous record last year. In a tribute to his staff, Mr. W. O. Kirkwood, Sunderland Divisional General Manager, said: 'Our workmen and technicians have done a magnificent job in the face of this heaviest demand ever. Through their efforts our plant is working well.'

Granton Works Visit.—A party of members from the manufacturing section of Edinburgh Chamber of Commerce paid a visit to Granton gasworks on January 23, and was shown around by Mr. J. P. Scott, Works Superintendent, and Mr. S. G. Melville, Jun. Asst. Engineer. At tea Mr. J. R. Martindale, Deputy Engineer of the Edinburgh division, welcomed the party and said that at present the works was producing 26 mill. cu.ft. of gas per day. If everything went as planned, they hoped in 1954 or 1955 to increase this volume to 36 mill. cu.ft. daily.

The Northern Gas Board has informed local authorities that the annual charges for gas street lighting will be increased by 3.2% owing to increased costs caused by higher wages for lamp attendants.

The Scottish Gas Board has been given authority by Kilmarnock Dean of Guild Court for the erection of a gas purification plant at Riverbank gasworks, Kilmarnock. The project is estimated to cost in the region of £52,000.

Long Service Awards were last week presented to 22 gas workers who have completed 25 or more years' service with the West Midlands Gas Board at Kidderminster. Between them the men had completed 6,444 years' service. Presenting the awards Mr. J. H. Wainwright said that 20% of the employees were receiving long service awards.

A Record of the Working of the Southern Gas Consultative Council, comprising the annual report for the year ended March 31, 1951, some interesting facts regarding the area of the Southern Gas Board, lists of members of the divisional committees, and useful hints regarding the use that consumers may make of the Consultative Council and its committees, has been issued in a handy and economical pocket edition of 16 pages and cover, priced at 3d. In a preface consumers are reminded that showroom staffs should be consulted in the first instance for consumer service, complaints, and advice. Failing satisfaction the local manager should be approached in writing, and only as a last resort a communication should be sent to the appropriate member of the Consultative Council.

The Whitland Butane/Air Experiment

Early Technical Report Promised

The butane/air gas experiment brought into operation by the Wales Gas Board at Whitland (Carmarthenshire) on January 22, and briefly described in last week's issue of the *Journal*, may well provide a solution to the problem of gas production and distribution in isolated localities where existing coal gas manufacturing plant makes undue demands on manpower or is more or less obsolete. The Gas Council regards the Whitland installation as a pilot experiment of national significance and is meeting early in April (in Wales for the first time) at Tenby, a few miles from Whitland, to get a close up view of the plant and its performance. A full technical report is promised within a few weeks. In the meantime an interim news statement on the scheme has been issued by Mr. T. Mervyn Jones, Chairman of the Wales Gas Board, who tells us that already those in charge of the scheme have had to cope with conditions of intense cold and heavy snow fall, most unusual in that area, 'and as each day passes new occasions teach us more.'

AT 8.15 a.m. on January 22, the coal gas making plant at Whitland was closed down and all gas consumers were supplied with butane/air mixture, says the Chairman's interim report. That form of supply will now be permanently continued at Whitland. Supplies of liquid butane in high pressure containers are now stored at the Whitland works. These have been delivered from the Llandarcy refinery of the Anglo-Iranian Oil Company.

French and U.S. Plants

There have been installed on site two alternative plants for making the butane/air mixture. One, a Mallet plant, imported from France, which is the plant now primarily used, employs two blowers, one for butane and one for air with a proportioning device to ensure a constant and correct mixture of butane vapour with air. The proportions in the mixture are in the region of three parts of air to one part of butane vapour. In cold weather the storage containers feeding the Mallet plant with the butane vapour have to be specially heated to ensure vaporisation of the liquid. Neat butane is employed as a source of heat for this purpose.

The other plant installed is a Gasair plant imported from the United States. This operates on the venturi principle whereby butane vapour under pressure aspirates the required amount of air to give a resultant gas mixture in order to ensure a correct mixture of butane vapour and air. This plant involves the use of a liquid butane vaporiser which is heated by means of neat butane. The Mallet plant is housed in a small building specially erected on the works site.

Unit in the Open

The Gasair plant is a self-contained unit standing in the open. Both of these alternative methods for the production of butane/air mixture have been installed specially at Whitland to enable full tests to be made of the alternative efficiencies and advantages of each method of manufacture. When sufficient experience has been gained a decision will be made as to which of the two alternative forms will be installed at any future undertaking which may be converted to this method of gas supply.

Mr. W. R. Branson, then Planning Engineer to the Wales Gas Board, and subsequently Mr. S. L. Wright, Gas Engineer to the Board, were responsible for arranging the installation, and operation of the plants. One of the assistants in the Planning Engineer's Department, Mr. J. Pickard, has been resident at Whitland since the autumn of 1951 in charge of the erection and installation of the plants.

The butane/air mixture from the now being supplied to consumers, has a low pressure gasholders on site. At Whitland, there are at present two holders, one of 11,000 cu.ft., and the other of 9,000 cu.ft. capacity. From the holders, the gas passes into the district through the undertaking's normal distribution mains and services and under normal pressure.

High Calorific Value

The butane/air mixture—*i.e.*, the gas now being supplied to consumers has a calorific value of 730 B.Th.U. per cu.ft. and a Wobbe index similar to that of normal town coal gas. This has meant that existing appliances can be used for the new gas with adjustments which can be carried out on the consumers' premises. To prepare the undertaking for the introduction of the new gas, all consumers' appliances and installations were examined and checked some months ago. This work was undertaken under the direction of the Distribution Engineer, Mr. W. T. Hird. An Assistant, Mr. C. J. Pope, has been stationed at Whitland since the autumn of 1951. Special adaptations also had to be made to all consumers' meters, in particular the treating of diaphragms to ensure their resistance to possible effects of the butane vapour. The opportunity has been taken not only to include a large number of different types of dressing, but meters with various types of synthetic rubber diaphragms have been installed.

Tests on All Appliances

The Wales Gas Board, realising the importance of this experiment to the gas industry generally and the value of obtaining full experience of the results of the use of the new gas in all possible circumstances, has arranged for the installation at Whitland of virtually all types of normal gas appliances which have now been suitably adapted to use the new butane/air mixture.

Throughout the first and second day of operation, visits were made by gas fitters specially drafted to the locality by the Board to make this final adjustment to all gas appliances. In the result, it was found that in the case of all consumers and all types of appliances the butane/air mixture worked completely satisfactorily and has ensured to the consumer a gas of high and constant quality.

Mr. E. M. Edwards's Idea

Continuous experimental work has been undertaken on butane/air mixture over the last few months both at the Board's headquarters laboratories and at Whitland. This work has been under the charge of the Board's Senior Chemists, Mr. L. L. Kliest and Mr. D. J. Turner.

Mr. Mervyn Jones comments that this system of making butane/air mixture and supplying it to gas consumers has been used for some years in the United States and France. This is the first occasion on which it has ever been so supplied anywhere in Great Britain. Mr. E. M. Edwards, whole-time Member of the Wales Gas Board, first contemplated and suggested its adoption here. Some two years ago he formed with Mr. W. T. Hird, Distribution Engineer. Mr. W. R. Branson, Planning Engineer, and Mr. S. L. Wright, Engineer, a 'Brains Trust' or working party to investigate and design the installation of butane/air plants. For various reasons they selected Whitland as the most suitable undertaking for the first installation. All that has been and is being done at Whitland is now being fully recorded and the results are being made available to all other area boards and the Gas Council, which will be meeting in the Whitland area and inspecting the plant during the first week in April. The initiative was taken by Mr. E. M. Edwards, apart from special work on appliance adaptation done by Watson House. All the work has been done by Mr. Edwards and the officers of the Wales Gas Board in Wales.

Tribute to Pioneers

'As a Board and as Welshmen,' says Mr. Mervyn Jones, 'we are proud to pay to them the high tribute we feel they deserve for their achievements as pioneers. They have given yet another example of the gas industry's constant determination at all times to investigate

all possible methods of gas manufacture and supply with a view to improving the efficiency and economy of the industry's services to its consumers.

'Events of the last two days have shown that the operation of changing over to this entirely new method of gas making has been completely successful. This is a tribute to the soundness and skill of the original planning and designing work and no less to the thoroughness with which Board employees sent to Whitland, particularly the fitters, have done their job. The technical investigation of problems of adapting consumers' appliances was undertaken on the Board's behalf in the Watson House laboratories of the North Thames Gas Board. They did this work with the skill, distinction and indeed enthusiasm for which they are rightly renowned.

'The change-over at Whitland made it necessary for fitters to inspect and adapt meters and appliances in the homes and premises of all consumers. We are glad to be able to thank them for the help, co-operation and indeed kindness that they showed on all occasions even at times when the work must have been inconvenient to them. Similarly the public representatives in Whitland gave every support and encouragement in the venture.'

The cardinal issue involved in the change-over is that of the price the Board will have to pay the oil companies for liquid butane. This for us the Board, as for the companies, is a difficult and important issue which is now the subject of negotiations. It is known, however, that the initial cost of installing a butane/air plant is far less than the cost today of installing a coal gas plant of the same capacity. The operation of the plant is simpler, indeed it is almost automatic, and takes less working time than the operation of an equivalent coal gas plant. At Whitland, on the first day, the plant was operated for three hours only and in that time made enough gas to meet Whitland's normal day's demand as against the usual 18 hours per day operation of the coal gas plant. The undertaking is a small one supplying only 240 consumers, and normally it consumes 538 tons of coal a year. That amount of coal, in itself a atter of national significance, will be saved. Its place will be taken by some 70 tons of liquid butane. As to cost of manufacture, on the basis of present price of coal and its transport to Whitland and the present general estimate of the probable cost of liquid butane, it can be said that costs of manufacture on the new process will not exceed those on the old.

'We intend to continue and not to increase the present price of gas per therm to the consumer at Whitland. The new process, it now seems to us, will never be introduced at larger gas undertakings, but we feel confident of our earlier decision seriously to investigate its introduction, subject, of course, to what has been said about price of butane, at our smaller undertakings of which in Wales we have many. If we do convert these undertakings to butane/air, the subsequent saving in consumption of coal will be substantial.'

Gas Service Conference

The Gas Council's Gas Service Conference in March will focus attention on the Council's competition and challenge trophy for Gas Salesmen's Circles. Mr. R. J. Gregg, Publicity Manager, will make a statement about the competition and trophy at lunch on the third day of the Conference, March 13.

The aims and rules of the competition, which is open to all Circles, are:

(a) To encourage individual members of Circles to prepare papers to be read at Circle meetings.

(b) To develop a spirit of competition between the Circles.

(c) To improve the standard of papers read at the meetings of Circles.

(d) To provide opportunity for the submission of constructive proposals for the improvement of gas industry sales practice.

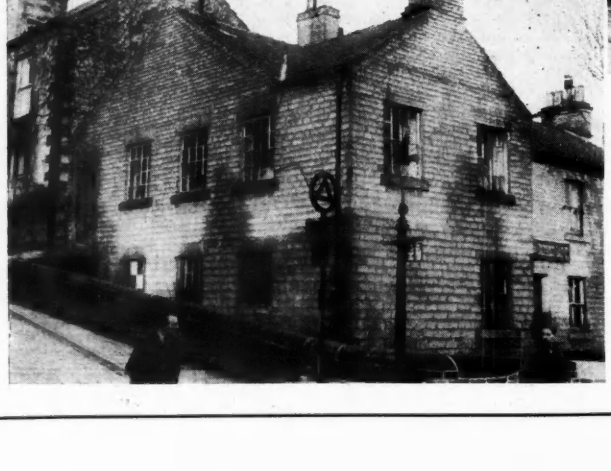
Each board will select what is considered to be the best paper read before Circles in its area, and the 12 papers submitted will be judged by an independent panel appointed by the Commercial Managers' Committee.

The author of the winning paper will hold the trophy for a year, and receive a miniature silver cup, and his name, together with that of his Circle, will be inscribed on the trophy. His paper will be read at the Gas Service Conference at which the award is presented.

The full programme of the Gas Service Conference was published in the *Journal* of January 16, (p. 159).

FROM SAWMILL TO SHOWROOM

A NEW service centre has been opened by the Peak Group of the North Western Gas Board in Chapel-en-le-Frith in what was originally a sawmill. The premises from which the new Centre has been adapted were acquired by the Board in 1949. They consisted then of a workshop, with a double-fronted house next door which was used by the Chapel, Whaley and District Gas Company as a small temporary showroom and office. The Board felt that these



were inadequate to the needs of the district, and decided to convert the original buildings into a compact modern Gas Service Centre. Our pictures of the site before and after the conversion show how successfully the problems presented to both architect and builder were solved. The Centre was officially opened on January 11 by Councillor W. H. Marshall, J.P., Chairman of the Chapel-en-le-Frith Urban District Council, who was welcomed on behalf of the Board by Mr. Harry Butters, Board Member.

B.B.C. Discussion on

Public Control of Nationalised Industries

THE question of how much public control should be imposed on nationalised industries was the subject of a discussion at the Manchester 'Fifty-One Society' broadcast by the North Region station of the B.B.C. The discussion was opened by Mr. D. N. Chester, Fellow of Nuffield College, Oxford, and formerly lecturer in Public Administration at Manchester University, and among those taking part in the debate were Mr. D. P. Welman, Chairman of the North Western Gas Board, and representatives of industry and of the North Western Electricity Board.

Mr. Chester said he was not one who would rush into control unless there was some good reason for it. The manpower and resources of those who were controlling others might be used for production of something of direct value. Also, too much control reduced the sense of responsibility in management. Thirdly, a large measure of public control usually meant that people in the centre, somewhere in Whitehall, made decisions which affect localities.

Good Reasons

On the other hand there were some good reasons for control. Sometimes a public department had information which the board of a nationalised industry had not. Sometimes, not always, public controls had technical knowledge which was not available to a nationalised board. And now, and again cases arise when the interests of the nationalised industries might conflict with the public interest. The boards of nationalised industries had 100% monopoly, and a board might have no reason to exploit the consumer for large profits, it might have no special incentive to reduce costs. Finally, it was true that they could choose a good board, and leave it if it was doing well. But how were they to know whether the board was doing well? In private industry, there was a simple test—the dividend. Was there a similar test in a nationalised industry? There was no dividend test. Was it just sufficient to say that receipts were covering expenditure?

Continuing, Mr. Chester said that his aim would be to try to avoid in the first instance control by any method. He would like to see some element of competition, for example, between gas and electricity. He thought they must avoid co-ordinating industries so tightly that they were not realy effective bodies. He would like to see a spirit of emulation between different industries or between different area boards. Secondly, he would like to see further developed a strong sense of public service in the management and working of nationalised industries. In so far as they had to have some kind of control over these industries, he would suggest that, as far as possible, there should be avoidance of day to day, or even annual, detailed scrutiny of the work of the boards, whether by Parliamentary committees or other bodies, because it was time-consuming and had a most inhibiting effect on management. Secondly, they had to have some good, simple machinery for dealing with consumers' complaints. He did not place too much stress on this, because the consumer was a very difficult person to organise, not always knowing what he wanted until he saw it in the shop window.

The first speaker in the discussion said that nationalised industries should be broken up as far as possible into local areas or districts. Central administration in London was fatal to the success of any industry.

Mr. A. R. Cooper, of the North-Western Electricity Board, commented that in principle local autonomy was sound enough. As fas as the electricity industry was concerned, they had this local autonomy in distribution boards which had direct contact with the consumers. But it was not so readily applicable for generation, which was carried out on a national basis. In general, control usually means that people could stop anything happening, and that they regarded it as a positive achievement if they could stop something taking place. He made a plea for those who were getting on with the job.

Another speaker commented that one of the great difficulties of the Parliamentary question at the present time was that the opponents of nationalisation used every question as a peg on which to hang, not a constructive suggestion about what ought to be done, but points in a campaign against nationalisation. The result was that the Minister, instead of acting as an impartial expositor of policy, and giving the appreciation that was really required, always regarded it as his job to defend the nationalised industry. There should be an objective approach to the problem.

Professor Blackett said he had been brought up and educated in a nationalised industry—the Navy. In that organisation it was realised that control had to be internal. It has got to be from the people on the spot. The spirit of socialised emulation had been working out in the armed forces for hundreds of years. The nationalised industries had taken over personnel which had never before had to work under such conditions. To give another example, the universities were not government controlled, but they were 80% government financed. But public control of the universities made nonsense. Internal control was essential.

Mr. Duffield said he was a member of a board of a fairly large company, and he was also a member of a consumers' council. When he sat on that council his sympathies were all with the members of the nationalised board, because he certainly would not like to come out of his board meetings and have to justify its decisions, as has to be done in many cases by the nationalised boards.

Professor Chapman said that what we seemed to have nowadays was a series of industries which were gradually producing more, but at higher cost; and the consumer was being crushed. Consumer councils had neither the necessary knowledge to be able to criticise, nor the power to influence decisions of those in whose grip the consumer was.

Mr. D. P. Welman remarked that it was unfair of Professor Chapman to charge the nationalised industries with inefficiency. Higher cost did not necessarily spell inefficiency. They had to pay more for labour and for commodities, and in such circumstances the consumer had to be charged at a higher rate. In this discussion they were rather assuming that the nationalised industries were in general inefficient, and must have supervision and control from somewhere else. He disagreed. The nationalised industries were not inefficient. As far as the gas industry was concerned, large economies were in fact being made. Before they talked about applying control they ought to make sure that they could bring their industries into the right organisational shape, break them down to sizeable units, and then offer inducements to the best men in the country to manage those units.

CENTRAL SCOTLAND GAS GRID

FALKIRK is to become the production centre for a gas grid which will serve the needs of the East Stirlingshire area as well as parts of West Lothian. Details of the first phase of the plan were given at Falkirk Dean of Guild Court on January 17, when the Falkirk District of the Edinburgh and South East Division of the Scottish Gas Board was granted a warrant to proceed with the extension of the retort house, including coal and coke handling plant, at the Falkirk gasworks. The Court also approved the erection of a new coke grading and storage plant at the works. The cost of the first phase was given as £173,800: the full plan, occupying 20 years, will, it is estimated, cost more than £325,000.

It is understood that when the scheme is completed Falkirk will distribute gas all over the East Stirlingshire area, including the rapidly developing industrial towns of Grangemouth, Polmont, and Denny. The scheme will also cover certain districts of West Lothian, including Linlithgow and Bo'ness.

It has not yet been decided how the existing works at Grangemouth, Polmont, Denny, Bo'ness, and Linlithgow will be fitted into the new scheme, but there is no likelihood of the works at these places being closed down in the near future. Works which are in good condition will almost certainly continue to be used as production units under the new scheme.

Sequel to Belfast Gas Explosion

Corporation to Pay £2,011 Damages

A GAS explosion in Belfast had as sequel a five days' hearing before the Lord Chief Justice of Ulster of an action for damages. The jury found that the plaintiffs, Shell-Mex and B.P., Ltd., London, had suffered a loss of £2,682, of which amount the Belfast Corporation, the defendants, were liable for £2,011. The explosion took place on April 11, 1949, in plaintiffs' premises, Airport Road, when five of their employees were injured and much damage was caused.

Counsel for the plaintiffs suggested that the explosion was caused by a spark while the Corporation's men were seeking a leak in the gas main which was 60 ft. from the plaintiffs' premises. The Corporation, he argued, was liable in law to prevent gas escaping into people's premises and if it failed it was liable for any damage done.

Mr. W. H. Waters, plaintiffs' installation manager in Belfast, said that when he came to the conclusion there must be a gas leak outside the premises he went out and 'got down on my hands and knees on the pavement at Airport Road and smelt to try and detect the leak.' He immediately telephoned the Gas Department and an official arrived shortly afterwards. The Corporation men were working with ordinary picks and shovels. His firm had special bronze non-spark tools for use where gas was concerned.

Gas Detected

For the defence, Mr. Eric N. Simpson, assistant distribution engineer of the Gas Department, described a visit to the plaintiffs' premises following the receipt of the complaint. As witness walked through the office block with Mr. Waters, the manager said he detected a smell of gas. It became stronger near a washhand basin. By using a gas leak indicator he found that gas was present at the escape pipe of the washhand basin.

Witness then learned there was no gas supply to the premises, and he advised Mr. Waters to send the staff away. He told the manager of Shell Mex that the Airport Road would be opened to stop the flow of gas into the office block.

Witness said that when the explosion occurred three of them were standing with their backs against the main office. The explosion came from behind them and there was dust everywhere. They seemed to be trapped, but eventually they made their way out through a roof.

In cross-examination, he said the first time he was certain it was coal gas was when he made test holes in the pavement. He did not notice whether there were any manholes on the road. In all cases in the escape of gas they used the ordinary steel tools and they used them on that occasion. It never occurred to him that it would be dangerous to use ordinary steel tools.

Mr. James Hyslop, Engineer and Manager, said the pressure main on the Airport Road was necessary to maintain the supply to Harland and Wolff, the shipbuilders. His Department received no notice of the laying of the sewer by the Harbour Commissioners and did not know it was there until after the explosion. If they had known it would have made no difference to the accident. At the point of the fracture of the main the soil had subsided. He thought the Harbour Commissioners consolidated the ground as much as they could when filling in after laying the sewer.

Asked about the use of non-ferrous tools when searching for leaks, witness said non-ferrous tools were never used in the open air. Steel tools were just as safe there. They had non-ferrous tools for inside work but they were far too soft for ordinary work.

Cross-examined, Mr. Hyslop said pressure from above caused the gas main to crack. The smells of coal gas and benzole were not similar. With notices in petrol premises, 'No smoking' and 'No naked lights,' and persons being searched for matches and petrol lighters, it was unreasonable to have an open coal fire.

Summing up, the Lord Chief Justice told the jury there was no controversy about the fact that the explosion was caused by coal gas which escaped from a gas main of the defendants. The main had been fractured and the fracture had been caused by a subsidence of the soil. The first contentious question was whether the defendants were negligent in their maintenance of the main in not taking steps to prevent the fracture. That was an important question, and he was bound to tell the jury that in law it was the duty of the Corporation to exercise a very high degree of maintenance for the purpose of preventing a leakage of that dangerous substance—coal gas.

It seemed to him astonishing that a main like that could be dug under and that no arrangement should exist for telling the gas undertaking that it was being done, or that the Corporation had no means of finding out for themselves.

The next question was whether the explosion was caused by the use of ferrous tools. If the jury came to the conclusion that the explosion was caused by something inside the building they could answer the question in the negative. The jury must also ask themselves if the plaintiffs could have avoided the explosion with reasonable care.

The jury found that the defendants were negligent in allowing the gas to escape and also that the plaintiffs could have avoided the explosion by reasonable care on their part. As stated, they found that plaintiffs had suffered a loss of £2,682 and that the Corporation was liable for £2,011 of that amount.

Belfast Increase.—The increase in the cost of coal announced last month will bring the average to 8s. 9d. per ton in the case of the Belfast Corporation Gas Department, representing an increase of £80,000 per annum. In the current year, the increase will be about £23,000. The figure does not provide for the expected increase in sea freight. Based on the same rate as the preceding figures this would add 1s. 6d. per ton to coal. In the meantime, as an interim figure till prices can be reviewed the City Gas Engineer and Manager has advanced coke by 9s. 9d. per ton, mixed breeze by 6s. 1d. and fine breeze by 2s. 6d. per ton. Increases in wages and gas oil amount to £32,000 per annum and as no additional revenue for gas is provided for in the current year the financial results will be adversely affected.

GAS IN TELEVISION PROGRAMME

A TELEVISION feature programme 'Britain's Power Resources' took place on January 21 and Mr. J. H. Dyde, President of the Institution of Gas Engineers and Deputy Chairman of the Eastern Gas Board, spoke on behalf of the gas industry.

The programme began with a film showing new power stations and extensions to gasworks, with a commentary by a 'man in the street' asking why, if all this work had been carried out, there should be constant electric power cuts. Diagrams were featured showing how the consumption of coal, electricity, gas, and oil had risen over the period 1937-51. Another short film followed concerning the use of power in industry. The commentator referred to the shortages of fuel and power and said that the greatest enemy is the domestic electric fire.

A representative of B.E.A. referred to the problem of the peak load and remarked that electricity cannot be stored. A lively discussion ensued in which Mr. Dyde held his ground with tenacity and determination. He called attention to the fact that the gas industry's policy has been to match demand to production capacity and that if a gas board is asked to accept a heavy industrial load and has not got the plant capacity to deal with it the load is refused. He explained how heavy demand is met by special peak load plant.

Mr. Dyde claimed that the gas industry, in producing solid smokeless fuel coke, and its main product, gas, can supply to the home heat for cooking, water heating, and space heating at an equivalent consumption of coal of half what could be done by any alternative method. Dr. A. Parker, Director of the Fuel Research Board, said that solid fuel in the form of coke is the most efficient method of heating for long periods and that for shorter gas or electricity is more economical. The main winter load for domestic heating should be taken by solid fuel which can be stored. The B.E.A. representative suggested that Mr. Dyde was giving a sales talk, but the discussion ended in good natured fashion, although it was obvious that all the participants would have appreciated more time to pursue their arguments.

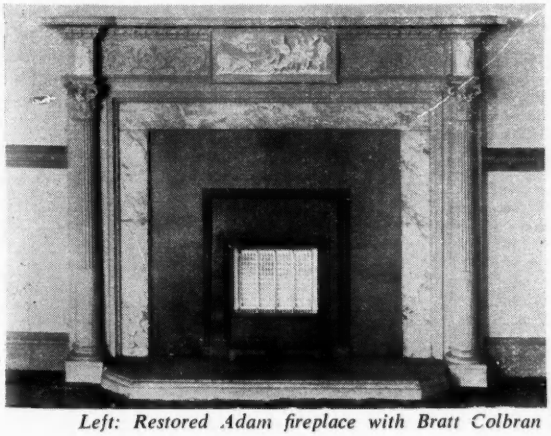
MODERN GAS SHOWROOM

IN GEORGIAN SETTING

Poole Transformation

POOLE, a name long synonymous with all that is progressive on the production side of the gas industry, is now the possessor of a most up-to-date showroom and demonstration theatre. The imposing Georgian house in the High Street, now known as 'Beechhurst,' was built in 1798, and when the Poole Gas and Coke Company was absorbed into the Bournemouth Gas and Water Company in 1902, it was purchased to provide new offices. The ground floor was later converted into a showroom, and in 1928 the present adjoining showroom was built. The Company, not wishing to spoil the architectural beauty of the house, built this new showroom to harmonise with its old and dignified neighbour.

This year the ground floor of the old building has undergone a complete transformation. Intricate friezes, long vanished under numerous coats of distemper, have been restored to their former beauty. An Adam fireplace has undergone similar treatment with most pleasing results. The accompanying pictures show how well the architects—Messrs. Reynolds, Tomlins and Dexter, of Bournemouth—and the local craftsmen who carried out the work, have succeeded in creating a demonstration theatre as modern as the hour and yet in keeping with the dignity of the past.



Left: Restored Adam fireplace with Bratt Colbran 'Penrith' fire. Right: Demonstration theatre ante-room.

GAS SUPPLY IN THE NORTH EAST

Mr. G. E. Currier Addresses Leeds Conference

THE Lord Mayor of Leeds, Lieut.-Col. F. Eric Tetley, welcoming 170 delegates to a conference at Leeds on January 22 attended by representatives of the East and West Riding Chambers of Commerce and the Combustion Engineering Association in collaboration with the Federation of British Industries, stressed the need for everyone to practise the utmost fuel economy. Mr. G. H. Kitson, Chairman of the North Eastern Regional Fuel Efficiency Advisory Committee, presided.

Mr. Bertram White, Technical Director of the Federation of British Industries, submitted that an examination of the trends of consumption of the main groups using coal suggested that in the course of 10 or 15 years, the total consumption would have outstripped the production of coal proposed in the National Coal Board's 'Plan for Coal' by many millions of tons, which would lead to a disaster greater than anything yet conceived. Too little thought had been given to this threat because of the attention being paid to meeting annual fuel crises, but to avert disaster there must be more coal and more electric power for industry and much more economy and efficiency in their use. A national fuel policy was needed today, he asserted. Industry was short of working capital as the result of taxation, and the cost of plant and materials had increased. Some incentive must be devised and some relief provided to encourage more rapid replacement of plant and improvement of fuel efficiency.

Meeting Demand

Mr. **G. E. Currier,** O.B.E., Deputy Chairman of the North Eastern Gas Board and Senior Vice-President of the Institution of Gas Engineers, gave a paper entitled 'The Supply and Effective Use of Gas.' In the course of this he said:—

On May 1, 1949, when the undertakings vested in the Board, the maximum daily output of the area was 134 mill. cu.ft. per day. Between that date and March 31, 1951, nine manufacturing stations, considered to be inefficient and uneconomic, had been closed. Nevertheless, the daily maximum capacity had increased to 137 mill. cu.ft. and the annual output had risen from 28,479 mill. to 32,604 mill. cu.ft.

Following a survey of all the plant available and of the potential domestic, commercial, and industrial loads, a development programme has been prepared. This provides for the installation of plant to raise the daily output to 175 mill. and the annual output to 39,600 mill. cu.ft. by March 31, 1956. The orders for reconstructions and extensions have been placed.

Provided that the construction of new installations already started, or ordered, is not delayed, full supplies of gas should be available at all times throughout the Board's area by 1956. But the uncertainties of forward estimates of this kind are illustrated by our experience at Tingley. Here a new works is in course of construction and the first unit of 7 mill. cu.ft. per day will be ready to go into commission during 1952. Unfortunately, the unit will be restricted to about 60% of its production capacity for 12 to 18 months because of delays in the delivery of cast iron pipes required to take the gas into the West Yorkshire grid.

Coke supplies are now reasonably satisfactory, although limitations have had to be imposed in certain directions. Supplies to domestic consumers, for example, must be regulated according to the number of coke burning appliances installed, and in use. The supplies position should progressively improve as new carbonising plants come into production.

Production and Utilisation

In the area of the North Eastern Gas Board the average thermal yield per ton of coal carbonised during the 12 months ended March 31, 1951, was:—

	Therms.
Gas	73.1
Coke and breeze ...	130.0
Tar	24.4
Benzole	0.2
	227.7

If we make the reasonable assumption that the average calorific value of the coal carbonised is 13,400 B.Th.U. per lb. (as received), which is equivalent to 300 therms per ton, then the average thermal recovery of the undertakings of the North Eastern Gas Board is 75.9%. While this is a fair average for the industry, the thermal recovery of modern carbonising plant can be as much as 85%, which is a very high standard of coal utilisation.

In the third report of the British Electricity Authority for 1950-51, the efficiency of electricity generation for the country is given as 21.5%.

The coal used for electricity generation is not of the same type as that used for gas production, but if for the sake of comparison, we assume it has the same calorific value of 300 therms per ton, then the electricity generated at 21.5% efficiency is equivalent to 1,890 units per ton of coal. The carbonisation process in this area has given a gas yield of 73.1 therms per ton of coal carbonised. From the same ton of coal is produced 9½ cwt. of coke and breeze, which replaces at least an equivalent quantity of raw coal. Therefore, allowing for the thermal value of the by-products recovered in the form of tar and benzole, the net yield is equivalent to 150 therms of gas per ton of coal. After allowing for distribution losses, the direct relationship between the energy which can be recovered from one ton of coal in the form of gas, and of electricity is in the ratio of 1 therm to 11½ units.

Coming to the utilisation of gas and electricity in domestic appliances, there is some difficulty in establishing a basis of comparison due to the widely varying habits of the people and conditions under which these appliances are used. It may, however, be fair and reasonable to take laboratory and field tests as a basis of comparison, in which case 20 units of electricity can be taken as the equivalent of one therm of gas.

Applied to the production and distribution equivalent of 11.5 units per therm, this utilisation efficiency of 20 units to one therm indicates that at least 1¾ tons of coal is required in the form of electricity to give the heat service provided by one ton of coal processed for gas production.

It should be remembered that nearly half a ton of coke is produced from each ton of coal and this will replace more than its equivalent weight of coal, owing to its higher utilisation efficiency.

Although the demand for gas by individual processes is progressively reduced by the considerable improvements in the efficiency of gas utilisation, the total sales of gas have increased steadily. In 1939 the total coal gas available for sale in Great Britain was 309,620 mill. cu.ft.: in 1950 it was 447,064 mill. cu.ft. Had the output remained at the 1939 figure, the country's coal requirements would have been 2⅜ mill. tons more per annum in the past eleven years, to maintain the heat service at the level obtaining in that period. This saving, equivalent to the annual output of 9,500 miners, is due entirely to the increased use of gas and coke.

Fuel Policy

The gas industry subscribes to the opinion expressed in the Simon Report that a national fuel economy must ensure that all fuels are used in the most efficient and economical manner, with due regard to the need for conserving the national reserves of coal. The National Fuel Policy should provide that each fuel is able to meet the peak demands for it. The acid test must be that future policy will be in the best interests of the nation as a whole, irrespective of the sectional interests of the coal, gas, or electricity industries.

Recent average increases per ton of coal on supplies to the various classes of consumer have been quoted as:—

	Additional cost per annum £1,000	Increase per ton s. d.	% Increase
Gas industry ...	8,850	6 4.3	12.0
N.C.B. coke ovens	2,863	5 11.8	11.8
Privately owned coke ovens ...	4,220	5 8.3	11.4
Railways	3,719	5 3.7	10.4
Iron and steel ...	1,961	5 0.4	10.0
Domestic	7,260	5 0.0	10.0
General industry	6,638	4 1.0	8.4
Electricity... ...	4,230	3 0.9	5.8

To say the least, the price policy indicated by these figures does not encourage the more efficient users of coal.

(*Concluded at foot of page 354*)

COKE EFFICIENCY GOES ON TOUR

During the early months of last summer the Southern Gas Board placed in service a vehicle specially designed to promote the sale and emphasise the efficiency of modern coke burning appliances.

SO courageous an enterprise in these days of coke 'stringency' seemed to us sufficiently noteworthy to merit more than passing reference in these columns; and we therefore asked the Southern Gas Board for details of the exhibition van and the policy governing its use. Not only did the Board readily provide all the information for which we asked, together with some excellent photographs, but invited us to inspect the vehicle while it was at the Portsmouth gasworks undergoing a re-fit after a strenuous season's work—during which, incidentally, it travelled upwards of 2,000 miles visiting over 30 different places throughout the Board's area.

At Portsmouth we found that Mr. Basil Miller, M.INST.T.A., Transport Manager of the local undertaking, had dressed the vehicle 'for action' in anticipation of our visit and had set it up just as it would be when on show—even to the extent of lighting the coke fire which was burning cheerfully within and greatly enhancing the general effect.

Before construction of the vehicle, consideration was given to the possibility of adapting a single-decker bus or to the use of a trailer body capable of being towed by a tractor unit or a mechanical horse. In this connection the Board had the advantage of the wide experience in transport matters of the General Manager of the Portsmouth undertaking, Mr. H. M. Lawrence, and it was finally decided to purchase a Dennis 3-ton long wheelbase chassis, on which was built, by J. Sparshatt & Sons (Portsmouth), Ltd., a special body to the Board's specification. The dimensions are: 19 ft. 9 in. long (overall), 7 ft. wide, and 7 ft. 5 in. high to the ventilators.

The body is of wood and light alloy panelled construction, with the near side hinged at the top to open up over a little more than half its length so as to form a canopy above an 'apron' measuring some 11 ft. by 9 ft. fronted by two steps, the whole giving a wide view of the interior. The canopy is fitted with a facia board and supported by plated stanchions, flanked by handrails and striped awnings.

A 'Live' Fireplace

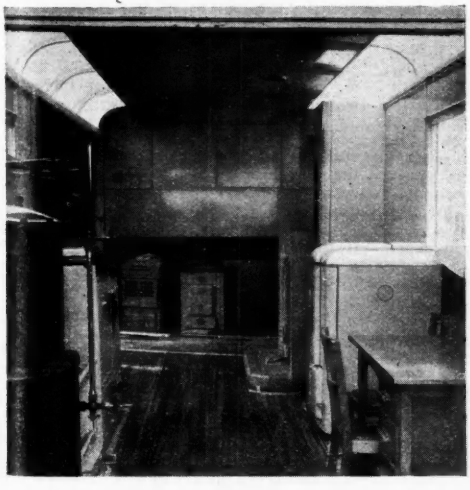
The appliances include a selection of gas coke grates, heating stoves, and boilers—one grate being installed in a 'live' surround which is vented through the side of the van. Care has been taken to prevent overheating and risk of fire by mounting the whole fireplace on aluminium runners insulated with asbestos sheet and by surrounding the back of the fire and the stack pipe with an air space through which air is continuously vented by suitable ports. To assist in lighting the fire an exhauster fan driven by the vehicle batteries is placed on top of the short stackpipe for use during the process of ignition.

The interior is decorated in cream with green horizontal panelling and linoleum floor covering. Curved perspex lights at eaves level and large windows give excellent natural lighting while artificial illumination is also provided. The rear of the vehicle opens, with further steps, so that the public can walk right through past all the appliances displayed. The demonstrator is provided with a small desk at the rear.

The vehicle is intended primarily to exhibit coke burning appliances in rural and semi-rural areas, but the possibility of conversion to display gas appliances has been borne in mind. Accordingly, the interior was made as basically simple as possible to facilitate the interchange of appliances if desired.

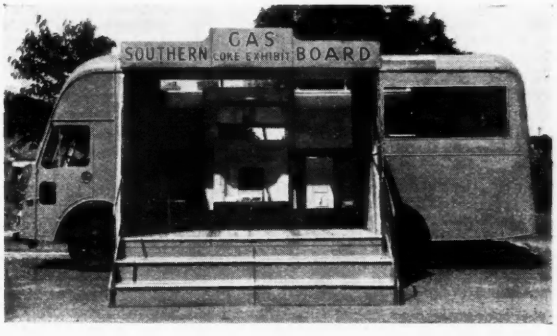
During last summer extended journeys were made to all districts within the Southern area, including a number of agricultural shows. The vehicle is in charge of one driver (whose duties include erecting and dismantling the platform and canopy) who passes under the control of the Group Manager responsible for the Group in which the town visited is situated. The site is arranged in advance, and a qualified demonstrator is provided by the Group or local undertaking to take charge during the time the vehicle is open for inspection. We understand that the Board plans to give the driver some basic instruction to enable him to act as demonstrator if necessary.

With this vehicle the Southern Gas Board has established an excellent means of publicising the efficient and economical use of coke and of providing a display at shows where the time and expense involved in erecting a 'permanent' exhibit are not warranted—as is particularly the case at one-day local shows. The Board is to be congratulated on its enterprise.



Left.—A view of the interior looking towards the front.

Below.—The nearside of the vehicle opened out for display.



Some Further Thoughts

ON THE SERVICE SIDE

CONTINUING from the *Journal* of January 23 our review of recent papers presented and discussed at meetings of gas salesmen's circles up and down the country we turn from coke to the rather lighter subject of films—a somewhat uncommon choice for a circle paper.

'Mr. Therm is my Film Star,' presented to Leicestershire and Northants division of the East Midlands Board by Mr. J. W. Brown, deals with the technical details which make a gas film show of really professional quality. On the sales link-up he says that wherever possible he likes to incorporate a film show with a small exhibition of gas appliances, which will enable the public to view the apparatus shown on the screen. One of our greatest assets, here, is the mobile showroom which requires little effort to present Mr. Therm to the rural districts where difficult transport conditions often prevent the village housewife from keeping abreast of modern trends. If a small exhibition of gas appliances is not possible, he finds that a film show and cookery demonstration unite extremely well, but in his view the ideal combination is a film show, exhibition, and cookery demonstration, bearing in mind that the right type of film should be chosen to blend with the cookery demonstration.

No Obligation

The author feels that a great many people are deterred from paying a visit to the showroom for fear it will place them under obligation to purchase. That fear, he says, should be suppressed at once. Most wives are aware of the benefits to be gained by using modern appliances, but husbands require more persuasion—*e.g.*, convincing sales talk plus a demonstration of the particular appliance. This is where films are persuasive. Mr. Brown states from his personal experience that the showing of a film has resulted in the sale of many appliances, which means that many wives, but still more important, husbands, have realised the advantages to be gained by installing modern gas equipment in their homes. The lack of knowledge of modern gas appliances, he finds, is often the reason for non-purchase.

Home service is represented in our review by some points from 'The Value of Home Service in Relation to Sales,' presented by Miss V. C. Narracott, Senior Home Service Adviser at Oxford, at a joint meeting of the Northern and Southern sections of the Southern Area Circle. Dealing with the staging of weekly demonstrations in the undertaking's demonstration theatre, she comments on how, at the conclusion of a demonstration, the audience often linger in the main showroom either to admire the attractive display of gas appliances with a view to a purchase or to give instructions for fitting work to be executed. For this reason she believes that in the planning of a new showroom, the ideal to be aimed at is for the demonstration hall to be situated on the same floor as the main showroom, and immediately adjacent to it, so that access to the hall is only through the main showroom.

To give an indication of the value of this branch of home service work she quotes the following figures: During the past three years the average attendance at demonstrations has been 70, the annual average total of demonstrations has been 29, and the annual total attendance has been 2,024.

Speaking of the presentation of demonstrations to women's institutes, townswomen's guilds, and other women's organisations in the Oxford area, she reports that this branch of the work expands each year, many new requests being received for demonstrations in addition to invitations to revisit those organisations already contacted. Usually, it appears, the local village hall or customary place of meeting is utilised and a temporary supply of gas is installed for the fixing of the demonstration cooker. The extra piping is removed at the conclusion of the demonstration and the complete cost of the work involved is borne by the undertaking. On such occasions, she says, it is a wise plan to use a modern cooker which is in good supply in the locality for, although no direct sales are made and no definite orders booked, it is reasonable to conclude that the outside demonstration work paves the way for valuable future sales.

Gas for Hatching

In the South Western area both circles are functioning energetically. A particularly interesting paper to the Northern Divisional Circle was given recently by Mr. R. K. Porter, Industrial Engineer to the Cheltenham sub-division. Entitled 'Potential Industrial Consumers,' the paper describes various loads which, although seldom large in themselves, nevertheless produce an appreciable figure in the aggregate. Such diverse applications, as hop drying, fruit ripening, dental work, farriery, etc., are mentioned, but we would single out a helpful note on the hatching and rearing of poultry. Mr. Porter points out that rapidly increasing numbers of producers and hatcheries are turning to gas as the fuel for their incubators and brooders. Any small paraffin-fired incubator can be converted to gas firing for a very moderate amount, giving a very much more accurate temperature control, and completely eliminating all the tedious and daily trimming of wicks and filling of lamps. Furthermore, the controlled humidity produced by the combustion of gas is essential. Brooders at present fired by paraffin lamp can be converted for a few shillings, as thermostatic control in this connection, though desirable, is not absolutely essential.

In large hatcheries, he remarks, a controlled temperature throughout the hatching house is very desirable, and here an air thermostat controlled boiler and suitable hot water installations are very suitable, as the chicks require a constant temperature in sexing and dispatching rooms after leaving the incubator. Lest it be imagined that the load to be derived from a hatchery will not be large, Mr. Porter instanced one installation in his area which started with gas in a very small way, and is now consuming 5-6 mill. cu.ft. per annum.

Future Needs

In the Southern division, the Salesmen's Circle recently received an inspiring address from their late Chairman, Mr. F. C. Gay, Divisional Secretary and Commercial Assistant. Speaking of future needs he stresses that the commercial man, from the departmental administrator to the salesman, must devote his activities to making the most of the facilities and opportunities presented to him for sales promotion. His position in his efforts to outsell his competitor is prejudiced if the quality and efficiency of the goods and service he sells do not progress with the times. The dangers of a 'seller's market' and over-standardisation are stagnation and the exact opposite of progressive development in the design and improvement of appliances. The whole future of our industry, said Mr. Gay, is linked with our ability to market labour-saving equipment of the highest standard of usefulness and appearance and to provide a service second to none. The manufacturers must be left in no doubt as to our requirements in this direction. It is suggested that far too much attention is being directed at the present time to low cost popular models of cookers for instance, which only satisfy an immediate need and will be regretted in the long run.

GAS SUPPLY IN NORTH EAST

(*Concluded from page 352*)

A coal price increase sets in motion a spiral of ascending costs and prices, ending no one knows where, and bringing in its train demands for increased wages, to set the process in motion again.

The production engineer devotes his energies to the problem of improving the efficiency of his manufacturing process. He may have worked hard and done well to increase his efficiency by ¼%. He tends to become discouraged if this progress is suddenly swamped as a result of coal price increase of 10% to 12%.

It may be said that the better gas coals must be conserved, but conservation could readily be effected by control of the production and allocation of these coals, without resort to unreasonably high prices. It may be argued, that the better gas coals are more costly to mine, but I thought that under nationalisation it was not essential for each pit to be entirely self-supporting.

Automatic Control of Calorific Value

By

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South Eastern Gas Board.

AUTOMATIC control, by virtue of its value to industry, is rapidly assuming importance among the newer technologies. It is employed for reasons both of efficiency and of economy. It provides for the replacement of the human operator, employed upon continuous and sometimes monotonous work, by an instrument capable of performing these duties with equal or sometimes greater efficiency without the possibility of human error.

In the past, attempts have been made to apply automatic control to calorific value by simple means which have not proved completely satisfactory. It was felt that progress in the design of modern controllers justified further experiment in which modern technique would be utilised.

The Principles Involved

Essentials for the application of automatic control are:—

(a) A selected physical quantity which may be liquid level, temperature, pressure, calorific value, etc.
(b) A device for measuring the value of this quantity—*i.e.*, a measuring unit. This may be a float, a thermometer, a pressure gauge, calorimeter, etc.
(c) A regulating unit—*i.e.*, a means for using the measurement to effect a change in the controlled quantity. In general, for the control of processes this unit is a valve which may be used to control the input to the plant of a liquid, steam, compressed air, diluent gas, etc., and
(d) The link between (b) and (c)—*i.e.*, a controlling unit.

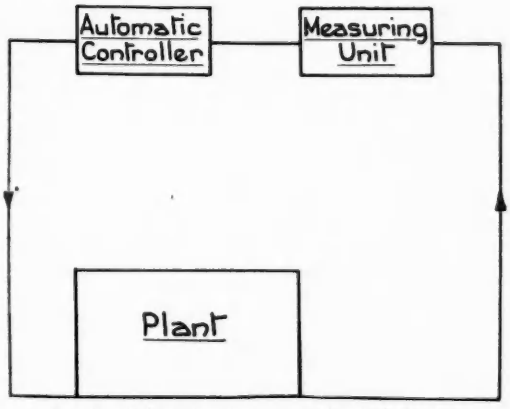

Fig. 1.—Schematic Automatic Control Layout.

The fundamental feature of this basic arrangement, which is shown diagrammatically in Fig. 1, is the dependence of the regulation on the measurement. It will be seen that by linking the regulating unit to the measuring unit the controller brings into being a 'closed loop.' The controlling unit operates the regulating unit and thereby varies some physical quantity associated with the plant. The quantity is measured by the measuring unit, and this in turn alters the controlling unit.

The efficient operation of an automatic control system is a simple matter where a change in the measured quantity is recorded immediately by the measuring device. The automatic controller is able to produce a signal of the necessary magnitude at the regulating unit and to compensate without delay for the variation which has taken place. In actual practice, however, it is found that many control applications are complicated by the fact that the change in the quantity is not detected immediately by the measuring device. It is the desirability of compensating for the finite time-delay that occurs between the various stages of such a process which has led to forms of control more complex than the simple controllers previously employed.

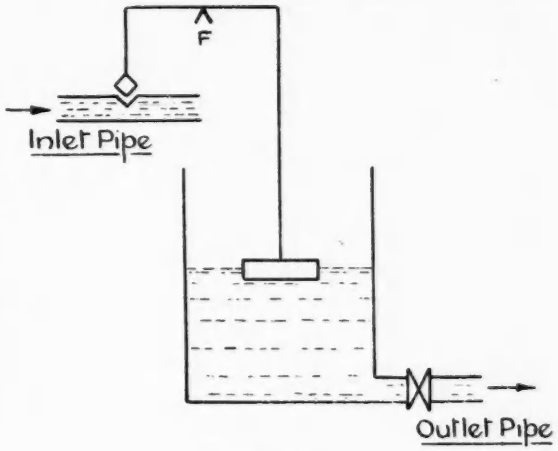

Fig. 2.

In recent years automatic process control has become the subject of rigorous fundamental analysis leading to a more complete mathematical picture of the phenomena involved; with the development of the subject there has arisen a specific terminology. In the preparation of this paper, however, an endeavour has been made to present the problems in simple language with a minimum of technical terms.

An analogy which may help to explain some of the complications of automatic control is the maintenance of a liquid level.

Fig. 2 shows a tank having inlet and outlet connections. The outlet is fitted with a manually operated valve, and the inlet with a simple control valve operated by a link mechanism from a float. The inlet valve has two operating positions, fully open and fully closed, these being determined by the position of the float. Suppose that the outlet is shut off, the level is at the desired position, and so the inlet is shut off; if the outlet is now opened, the level falls, and the valve in the inlet line opens, admitting liquid. The level then rises until, at the desired level, the inlet closes again. This constitutes what is known as on-off control. While the outlet pipe is open the level in the tank fluctuates, demonstrating the phenomenon known as 'hunting.' In many cases the fluctuations are of small amplitude and control is satisfactory.

If a slight modification be made to the system shown in Fig. 2 a more complex form of control becomes necessary. In the example shown in Fig. 3 the float is

installed in a side section of the tank, this side section communicating with the tank through a valve which acts as a restriction. Suppose that the outlet is closed and the tank level is that desired. The outlet is now opened and the liquid levels in both the main tank and the side tank begin to fall. The level in the side section falls more slowly than that in the main tank, so that the control valve operates after a longer period than was the case in the example shown in Fig. 2. The reverse effect occurs when the levels are rising, so that the amplitude of 'hunting' is greatly increased. It can be seen, therefore, that on-off controllers are not always satisfactory, and in some cases a more complex system is required.

Suppose that in the example shown in Fig. 2, instead of two flows alone being available—*i.e.*, full-flow and no-flow—intermediate rates of flow can be obtained by means of an arrangement which ensures that larger movements of the float are necessary for the full opening of the valve. As soon as the outlet valve is opened the float begins to move and the control valve immediately begins to open. The initial change thus tends to be corrected. The further the liquid level falls, the wider the inlet valve opens. In other words, there exists a form of 'proportional control.' This type of control is exemplified in Fig. 2 by the link between the float and the valve.

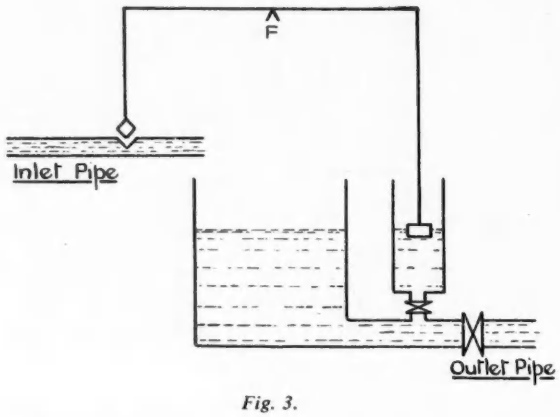

Fig. 3.

This link pivots about the fulcrum F. If the fulcrum be moved along the beam, the float-movement, which is necessary to cause the valve to travel from the fully open to the fully closed position is varied. With the fulcrum at the valve-end of the beam, considerable movement of the float is necessary to achieve complete valve movement. With the fulcrum at the float-end of the beam a very slight movement of the float causes the valve to move from fully-open to fully-closed, corresponding to the on-off controller of the earlier illustration.

Proportional control, though more satisfactory than on-off control, suffers from one defect. In the liquid level example, a continued change in outlet flow would lead to a new stable level. An installation will be considered in which the fulcrum has to be near the valve, the level is initially stable, and the inlet and outlet flows are equal with the valve at its mid-position. If a small increase in the outlet flow occurs, a new condition arises, where again both flows are balanced. Since the outlet flow has increased, this new stable position can be achieved only if the inlet flow increases. Hence the control valve must be at a position different from its initial position, and so the float must now be at a different position. The example further shows that the nearer the fulcrum is to the valve, the more pronounced will be this effect, since to produce a slight change in valve position a much greater float movement is required, and consequently a much greater change in the control level is obtained. This limitation, which is known as 'off-set,' is inherent in all proportional controllers.

An examination of the example shown in Fig. 2, therefore, leads to two fundamental facts concerning proportional controllers. As the fulcrum approaches the float-end of the beam, the controller tends more and more to become an on-off controller which will operate by producing the previously described phenomenon known as 'hunting.' As the fulcrum approaches the valve-end of the beam, the controller resembles less and less the on-off controller, but the phenomenon known as 'off-set' increases.

In many practical cases considerable power is required to operate the valve, and it is therefore not possible to link the measuring element directly to the controller. Instead, an intermediate stage is employed which accepts the measuring signal, amplifies it, and uses this higher power signal to actuate the valve. Most controllers are compressed air devices, constructed of pneumatic bellows and restrictors, arranged to give the desired output signal.

The principle used to design controllers which will overcome the limitations of off-set can be indicated by the example of Fig. 2. A proportional controller fails because once the float is stationary, the valve also is stationary. A controller has been designed, therefore, in which the difference between the actual position of the float and the desired position is taken as the actuating signal, and unless this quantity is zero the valve will continue to move. The valve movement is so arranged that the greater the deviation from the desired value, the faster does the valve move in the direction which will tend to correct the deviation. In this case, if such a controller is used alone, and if the outlet flow is increased, the float will fall; all the time there is a deviation from the desired level, the inlet valve will continue to open, until finally the level is restored. At this level and at this level only will the valve stop moving, but it will now be in a position different from its original position. This form of control is known as 'integral control,' and used alone leads to hunting. It is, therefore, normally combined with a proportional controller.

A third term has been found to be of particular value in processes where the time-lag between measurement and control is considerable. Its operation may be considered as follows. If the level is falling at a constant rate and a proportional controller is installed, the falling level in the tank will be followed by the gradual opening of the inlet valve. The addition of the new corrective term, however, causes an immediate valve opening, the magnitude of which is proportional to the rate at which the level is falling. As in the case of the integral term, it is possible to vary this adjustment. This term is known as the 'derivative term' since the control valve position is made proportional to the rate at which the controlled physical quantity is changing. It can be seen that a sudden rapid fall in the tank level would be corrected by a large initial opening of the inlet valve, this extra correction decreasing as the rate at which the level is falling decreases.

In the modern three-term controller each of these terms is incorporated, the mechanism being arranged in such a manner that the magnitude of each term can be varied. Any particular process may then be controlled with maximum efficiency. The experiments under consideration have been carried out using controllers of this type.

Instruments for Controlling Calorific Value

The problem was first approached by a consideration of the instruments available for recording calorific value from the standpoint of:—

(i) Accuracy;
(ii) Reliability;
(iii) Suitability when used as the measuring device in a control system.

Choice fell upon the Fairweather calorimeter and the Sigma calorimeter.

It was realised that since the mechanism of the Fairweather calorimeter is that of the water flow calorimeter, it measures calorific value in terms of absolute standards. The Sigma calorimeter is, however, an inferential instrument. It was felt that this of itself should not be regarded as a disadvantage for control purposes, but it was realised that a water flow calorimeter would also have to be installed for the initial setting of the Sigma calorimeter. It was also recognised that, over long periods, the consistency of the results obtained using the Sigma calorimeter is not of the same order as that obtained using the Fairweather calorimeter. Provided that any error is noted within 12 hours, and that the desired value pointer is re-set on the control mechanism to the result obtained by the water flow calorimeter, no real difficulty is encountered.

Practical considerations of reliability pointed to the advantages of using the Sigma. The number of steps in the chain of control is very much smaller with this instrument, and therefore the possibiity of failure of the installation is minimised. The necessity, in the case of the Fairweather, for a water supply is itself a disadvantage, if continuous, unsupervised running is a primary consideration. Additionally, the fact that the Sigma system requires no electrical supply obviates the possibility of an electrical failure. Both calorimeters are subject to a time-delay which occurs between the sample of gas reaching the calorimeter and its calorific value being recorded. First the gas sample must travel from the inlet of the calorimeter to the burner. The operation takes a finite time, in the case of the Fairweather calorimeter 3 to 4 min., and in the case of the Sigma calorimeter 1 to 1½ min. This time may be regarded as dead-time, because during this period there is no response whatsoever by the calorimeter to a change in calorific value of the gas. The gas sample then reaches the burner and the heat input to the measuring system is changed. It must be noted that, if the change be, say, +50 B.Th.U., the calorimeter will not immediately record this value; a finite time must elapse during which heat is transferred either to the water in the Fairweather calorimeter or to the expanding tubes of the Sigma calorimeter. In fact, should a change of 50 B.Th.U. be instantaneous in the gas sample at the burner, the response of the calorimeter would be a smooth curve which gradually tends to the correct value. It is the first of these lags—the 'dead-time' during which nothing at all happens—that is of major importance. From this point of view the Sigma calorimeter arrangement definitely has the advantage.

In order to employ these instruments as controllers, it was necessary, in the case of the Fairweather, to utilise a potentiometer, the one finally selected being the electronic model produced by Messrs. Elliott Bros.; it was found that a standard Foxboro-Yoxall Model 40 controller could be very easily adapted for use with the Sigma recording calorimeter.

The Fairweather-Elliott System

The Fairweather calorimeter is a standard instrument and so it is considered unnecessary to describe it in detail. For control purposes, however, some modification has been found essential. Thus, the Wheatstone bridge circuit with its two resistance thermometers is fed with A.C. instead of D.C. A change in temperature of the resistance thermometers unbalances the bridge, producing an A.C. output signal. This output signal is too small in itself to actuate the control system, and is therefore fed to a two-stage electronic amplifier. The output signal from the amplifier actuates a phase sensitive motor mechanically coupled to the sliding contact of an oil-immersed slide-wire. The slide-wire completes the Wheatstone bridge circuit, the function of the sliding contact being to restore the A.C. bridge to its balanced condition; in so doing, however, a permanent record of the position of the sliding contact is made upon the chart by a pen attachment. The sequence is as follows:—

A change in calorific value leads to a variation in the value of the resistance of the 'hot thermometer,' the A.C. bridge becoming unbalanced, a small A.C. signal being fed to the amplifier. The amplified A.C. signal passes from the amplifier to the phase sensitive motor, which rotates and controls the position of the sliding contact. This sliding contact is moved in a direction such that the bridge returns to balance, and the new position of the contact indicates the calorific value.

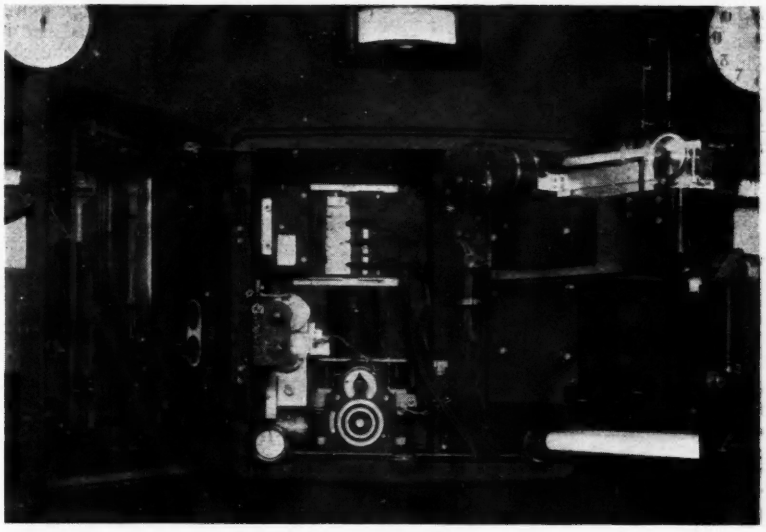

Fig. 4.—Fairweather-Elliott System.

It is worth noting that the mechanism has been arranged in such a manner that after a change in calorific value the new pen position is taken up rapidly (3½ sec. for full scale travel) and without noticeable overshoot.

The Elliott controller is a three-term controller, so designed that the type of control action can be varied as desired.

The generation of the final pneumatic signal is briefly as follows:—

The Wheatstone bridge sliding contact already described is mechanically coupled to a second sliding contact. This travels over a slide-wire which is connected in a simple D.C. circuit. The output from this circuit may be regarded, therefore, as a direct function of the deviation from the controller set point. The output is fed to a device which converts the electrical signal into a proportional pneumatic signal. This device is essentially an electrically operated pneumatic valve. The air pressure obtained is proportional to the deviation from the desired value and is fed to a balanced beam system which generates the integral and derivative terms. This unit actuates a pilot valve from which the controller output pressure is fed to the final control valve.

The sequence of events is as follows:—

A calorific value change having been recorded by the Wheatstone bridge slide-wire, the D.C. sliding contact in the control system receives a displacement. Consequently a D.C. signal is fed to the 'pneumo-electric' converter, and from this a pneumatic pressure, proportional to the calorific value deviation, is fed to the balanced beam system. This generates the output signal desired in accordance with the specific dial settings employed, and the final control valve takes up a new position.

The Foxboro-Sigma System

In this system the calorific value of the gas is measured by means of a Mark II Sigma recording calorimeter. It is felt that this instrument should require no description here, but it must be pointed out that the instrument used has been the modified model recently made commercially available by the Sigma Instrument Company. This model incorporates an aneroid, coupled to a small butterfly valve, which controls the admission of secondary air to the burner at a rate proportional to the barometric pressure. The introduction of the device appears to have considerably improved the performance of the recording calorimeter; and it was, in fact, the increased accuracy of the new model that led to its consideration as the measuring unit.

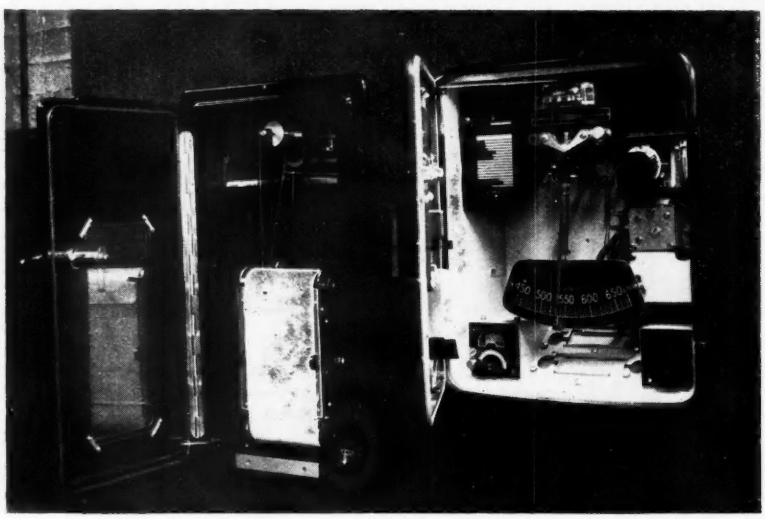

Fig. 5.—Foxboro-Sigma System

The instrument has been coupled mechanically to the basic nozzle-flapper unit of a Foxboro Model 40 three-term controller, and this component enables a pneumatic pressure to be fed to the control valve. The controller is completely pneumatically operated, air pressure being supplied to an arrangement of Bourdon type restrictors and bellows so arranged that the desired pneumatic pressure may be supplied to the control valve.

Practical Application

The most important factor to be considered is the time-lag between an alteration in position of the control valve and the resultant effect on the recording calorimeter.

In the case where the diluent available is unpurified it will be admitted to the main stream, usually before the exhausters. The latter therefore will ensure adequate mixing. It will be necessary to pass the gas sample which feeds the calorimeter through small purifiers. The sample point must be selected so that any delay caused in the small purifiers will be less than the delay caused, in the main stream, by this purification.

Should purified gas be available for dilution, then it can be admitted at the inlet to holder, provided adequate mixing facilities are made available.

It is obvious that the latter system will lead to the best results, as regards both quality of control and ease of maintenance. The details of any particular application will have to be decided in accordance with the principles quoted, in order that the most efficient installation shall be obtained at a reasonable capital cost.

At the Rotherhithe works of the South Eastern Gas Board, where experiments were carried out, coal gas is produced in two retort houses. In No. 1 house, provision is made to add to the stream producer gas from any one of three suction producers. This mixed gas meets gas from No. 2 house, and into the common main waste gas can be drawn.

Control is carried out by varying automatically the position of a 6-in., pneumatically operated, butterfly valve which is installed in the waste gas main. Should seasonal conditions cause large load changes, the quantity of producer gas is varied manually, so that the waste gas is never completely shut off.

The system has been designed so that dilution is accomplished by the use of waste gas, since it was thought desirable that for these initial experiments additional complications should be avoided as far as possible. It is obviously preferable from the gas-making point of view to use not waste gas but producer gas for this dilution. It may well be that this is possible, but to install such a system might have led to complications, since at the works where these experiments were carried out it would be possible to use for dilution only uncleaned producer gas. Arrangements to keep the control valve freely moving might have proved necessary, and so it was felt that for the initial experiments, which were designed only to demonstrate the applicability of the system, it was better to eliminate as far as possible any additional difficulties.

The mixed gas passes in sequence through primary coolers, exhausters, secondary coolers, and electro-detarrers before reaching the point at which the sample is tapped off. Since the whole make of the works passes along one main, the velocity is high and the time taken is not more than 30 to 40 sec.

The sampling line is connected to the outlet main from the detarrers and consists of a 1-in. pipe which by-passes gas back to the inlet of exhausters. This by-pass service is brought as near as is practicable to the control room, and a sample of gas is purified and continuously fed to the calorimeter. The pressure at the outlet detarrers is 40 in. W.G. and the pressure at the inlet of exhausters is −7 in. W.G. giving a differential pressure of 47 in. W.G. for this channel. Rough calculations show that the maximum flow obtainable is about 1,000 cu.ft. per hour, and, since the overall volume of the line is 1.1 cu.ft., the total dead-time involved need not be greater than 5 sec. However, the situation is complicated because at the mid-point of the line—*i.e.*, the point at which the gas is taken off to the purifiers, a pressure of 25 in. W.G. must be available to feed the gas through the purifiers. This condition is obtained by the use of two cocks (see Fig. 6), and adjustments to these cocks are made to produce the maximum possible flow along the by-pass line consistent with the requisite pressure being available at the sampling point.

The gas contains quantities of naphthalene, and it has

been found necessary to steam out the sampling pipe once a week to keep it clear of deposits. To facilitate this operation the entire system has been installed in duplicate, it being possible to use one service while the other is being cleared. It is obvious that, as the line becomes blocked, the rate of flow falls and the lag in this portion of the system increases. Two venturi tubes have been constructed, and these are installed, one in each line, so that it is possible to work to a definite flow reading.

The small purifiers consist of:—

1. A sulphuric acid bottle to remove ammonia.
2. An oxide tower to remove H_2S.
3. A picric acid bottle to remove naphthalene.

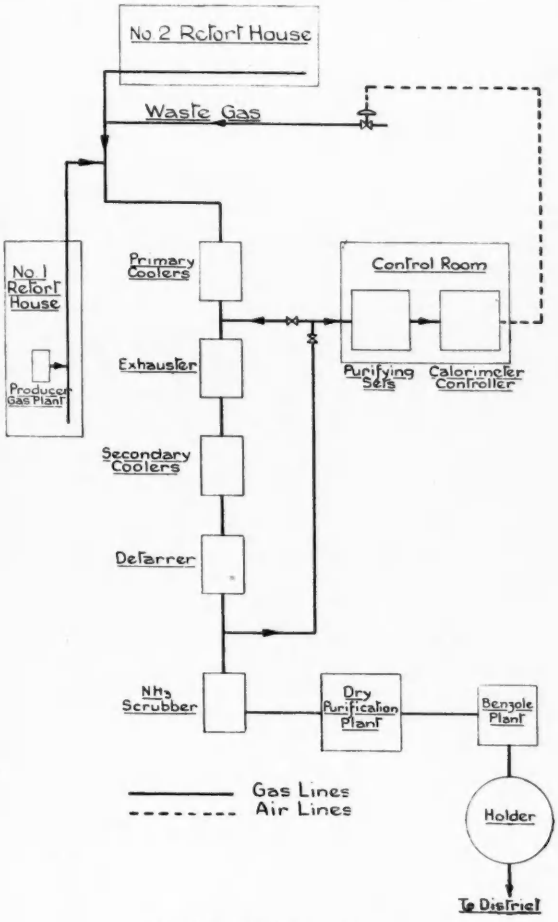

Fig. 6.—Installation Diagram.

By designing the acid bottles in such a way that the free space is kept to a minimum and appears in the 'neck' of the vessel, where the cross-sectional area is small, the lag in the wet purification system has been considerably reduced.

The oxide tower, however, cannot be modified so easily, since the free space involved is a function of the particle shape of the oxide employed. The tower has been so designed that the free space is a minimum and the overall lag in the purifying system is about 30 sec. when the volume flow is 5 cu.ft. per hour.

To produce a system having such a small lag, it has been necessary to use purifiers which need to be changed daily, but these purifiers have been constructed in such a manner that this operation is simple. Two sets are provided so that one may be serviced while the other is in use.

A further time-lag occurs between the outlet of the small purifiers and the recording calorimeter. It has been possible to arrange that the distance involved is about 6 ft.; thus the lag in this part of the system is not more than 5 sec.

The total lag which occurs between the movement of the control valve and a sample of the gas, whose calorific value has thereby been changed, reaching the calorimeter is less than 2 min. To achieve this, however, it can be seen that considerable care has to be taken in the design of the installation.

It is obvious that the effect of the change in valve position is, first, a considerable dead-time, and next an exponential curve which only slowly reaches the new calorific value. In this particular case, the equipment can be arranged to deal with the problem created by heat transfer lag, and it is the dead-time occurring in the system which is of primary importance. Experiment has shown that, under normal running conditions, the nature of the process is such that in 8 min. the calorific value of the gas made in the retort houses may vary by 5 B.Th.U. per cu.ft. If it is assumed that the change may take place in either direction, it becomes evident that with a distance velocity lag of 8 min., control can never be better than $\pm 1\%$. In practice it is found that under these conditions it is possible to obtain a gas whose calorific value does not vary by more than $\pm 2\%$.

If the distance velocity lag is reduced to 4 min., however, control better than $\pm \frac{1}{2}\%$ cannot be obtained, but it is possible to obtain control of $\pm 1\%$ over long periods. To obtain this improved control, once the lag in the system has been reduced as far as possible, it is necessary to make use of an instrument in which the measurement lag is reduced to an absolute minimum.

Results Obtained

Copies of three charts showing the calorific value of the gas at the inlet to holder are shown in Figs. 7 (*a*), 7 (*b*), and 7 (*c*). These show the results of:—

(1) Manual control.
(2) Control by the Fairweather-Elliott system.
(3) Control by the Foxboro-Sigma system.

It can be seen that using manual control the maximum deviation from the desired value is $\pm 3\%$, while the results obtained with the Fairweather-Elliott system are within $\pm 2\%$. The best results are obtained with the Foxboro-Sigma system, and here the deviations are just over $\pm 1\%$. These results confirm the analysis of time delays which was referred to in the text, and the improvement obtained by the use of the Foxboro-Sigma system is a function of the much shorter dead-time or measurement lag, associated with this type of instrument.

A possible future development is the use of a Sigma installation with an over-riding signal generated by a Fairweather-Elliott instrument. This would compensate for any inaccuracies of the Sigma calorimeter, while making full use of its superior features as a measuring unit. In the meantime experimental work which, if successful, will render such an installation unnecessary is being undertaken with a view to improving the performance of the Sigma calorimeter.

Further completed experiments have confirmed the practical possibility of employing an automatic control system in the case where producer gas, generated in a suction producer, is the diluent.

Investigation shows that a typical day's coal gas output may vary in calorific value by $\pm 10\%$ and in volume by $\pm 15\%$. A controller can be installed to maintain the ratio between the flow of coal gas and the flow of diluent gas

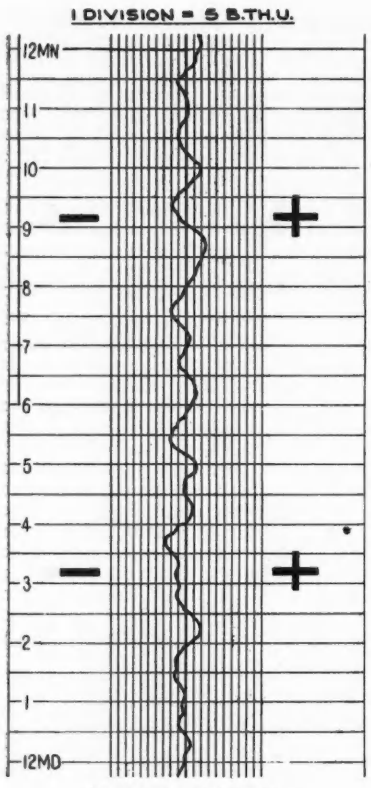

Fig. 7a.

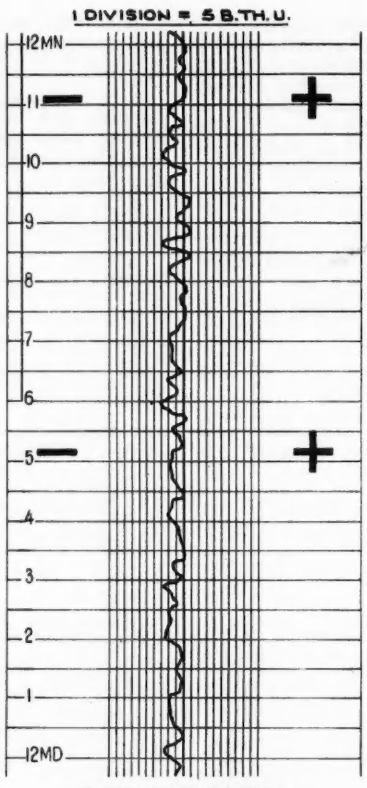

Fig. 7b.

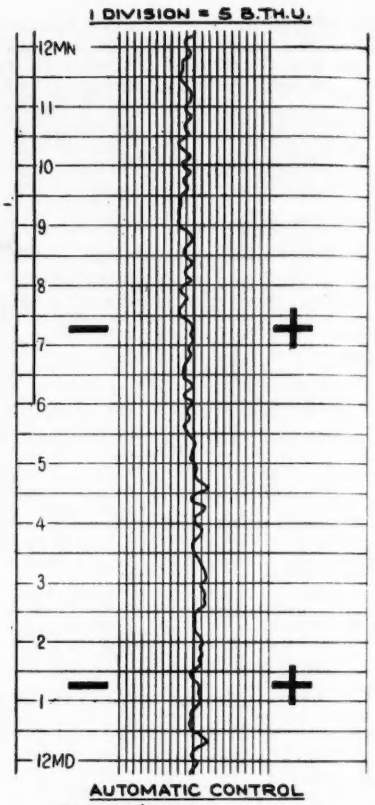

Fig. 7c.

at any desired value, and since the time lag for a flow-meter installation is very small the controller can be expected to give a very good performance. The ratio can be set automatically, by the calorific value controller, to satisfy calorific value requirements. Such a system should give a much improved performance, since the calorific value controller would have to correct for only one variable. A system of this type is being installed at the East Greenwich works of the South Eastern Gas Board, and when sufficient experience has been gained the results will be made available.

The authors desire to thank the South Eastern Gas Board for permission to publish these notes and also to acknowledge the help they have received from colleagues who have co-operated during the experiments. They also wish to express their appreciation of the assistance they have received from the technical staffs of the instrument firms concerned.

NATURAL GAS IN ITALY

A RECENT issue of the *Financial Times* dealt at some length with the rapid expansion in the use of natural gas in Italy, where for four years now the amount produced each year has been double that of the previous year.

The amount produced in 1951, it was stated, was approximately 20,000 times higher than ten years ago, being some 34,000 mill. cu.ft. Already nearly 1,000 miles of pipelines have been laid, requiring about 64,000 tons of steel. The present pipeline network can carry 88 mill. cu.ft. a day.

By early next year all the main industrial centres of Northern Italy will be supplied with this fuel, and the dependence of Italian industry on imported coal will be reduced to a fraction of that now required.

The use of natural gas by Italian industry would proceed even faster were it not for legislative difficulties. The Government has declared that it intends to create a State-controlled monopoly for prospecting, exploitation and sale of natural gas in the Po Valley, most of which comes from the State-controlled Agip gasfields south-east of Milan in the Piacenza area, but the necessary legislation has not yet been introduced.

The gas is now being sold to industrial consumers at an average price equivalent to about ½d. for 10 cu.ft. The present price is based on the current price in Italy for coal and fuel oil and not on the production cost of the gas, which is probably about one-twentieth of its selling price.

The replacement of coal gas with natural gas for domestic use, particularly in the larger towns, is meeting with strong opposition from the local gas undertakings, many of which are municipal, because it would render their plants useless and would oblige them to replace all the distribution pipes. The natural gas is piped at a pressure about ten times higher than coal gas.

In five to ten years' time Italy's coal imports will probably be cut to one-fourth or one-fifth of what they are now, particularly if the planned pipeline down the backbone of Italy from north to south is built, thus rendering natural gas available throughout the whole country. Negotiations are in progress for an American loan to enable this pipeline to be built.

Italy, the article concluded, may soon be exporting natural gas to Switzerland, and possibly also to France.

London and Southern Section, I.G.E.

The Application of GAS TURBINES IN THE GAS INDUSTRY

By A. W. POPE, B.Sc., A.F.R.Ae.S.,
W. H. Allen Sons and Co., Ltd.

In this paper to the London and Southern Section of the Institution of Gas Engineers the author puts forward the view that time and money spent on the development of the gas turbine will be well worth while. He explains the application of the gas turbine in conjunction with continuous vertical retort plant.

AFTER the war it was realised that the gas turbine had become a practical prime mover, and naturally much thought was given to its application in industrial, locomotive, and marine work. This paper deals only with the application to industry.

It was found immediately that the gas turbine would be a great deal smaller and lighter than orthodox prime movers. Also, it was judged that the maintenance costs would be of the same order as the steam turbine and substantially less than the diesel. The disadvantages of the gas turbine are that it has a higher fuel consumption, and cannot yet burn cheap residual fuel or coal.

The simplest type of gas turbine has one compressor and one turbine on a single shaft which also supplies the power to whatever is being driven. A more common engine has the additional refinement of a separate power or work turbine. This gives greater flexibility and means that the engine can be used for many different purposes and that the part load efficiency is better in some cases. Without a heat exchanger this type of engine will have a thermal efficiency of about 16%, but if fitted with a heat exchanger (70% thermal ratio) its thermal efficiency will rise to about 24%. The Allen gas turbine is a typical example of this type of engine. The compound engine has an efficiency of about 28%. It is a more complicated engine with two compressors and two turbines and two separate shafts, and often includes intercooling between the compressors and a heat exchanger.

The Swiss engineers were first in the field with industrial gas turbines and started work before the war. They have developed along different lines from us, and are mainly concerned with large power station units. The overall thermal efficiency of the Sulzer semi-closed cycle is high, 32%, and the degree of complication gives a good part-load efficiency. The Escher Wyss-John Brown closed cycle engine is fairly well known now. It lends itself particularly to very large powers, as by pressurisation the compressors and turbines themselves can be kept quite small.

Other sets running in this country include two experimental 500 H.P. sets, one built by John Brown, Ltd., and the other by C. A. Parsons, an open cycle 2,000 kW set running in the Metropolitan-Vickers works, and lastly, a 750 kW set running in Ruston & Hornsby's works.

Application of Gas Turbines

It is difficult to forecast the future of the industrial gas turbine because, for example, coal is in short supply, although we ought to burn it from the national point of view, and oil is very dear. It is clear that the gas turbine has a use as a peak load and standby set. It is not yet able, however, to compete economically with other base load prime movers because it does not burn coal or residual fuel. There are, though, a number of applications where an efficient engine is required for generating electricity, but where the utilisation time is quite small. In these cases it is generally agreed that the gas turbine can compete economically. There is, for instance, the difficulty with coal fired boilers of banking the fire when power is not required.

There is no doubt it will be necessary to burn heavy fuel and coal in gas turbines before they can come into their own. The actual combustion of heavy fuel is solved, but the problem of preventing corrosion and the deposition of mainly sodium and vanadium compounds on turbine blades is not yet solved, although it is receiving much attention from several people—for example, the Shell Petroleum Company.

Development

A considerable amount of long-term development work is in hand, which was mainly started by Dr. Roxbee-Cox, Chief Scientist, Ministry of Fuel and Power. It was dealt with in lectures of his to the Institute of Metals and Institution of Mechanical Engineers. Roughly recapitulating his Institute of Metals lecture, it seems that there are three ways of burning coal: Firstly, by direct internal combustion of pulverised coal in the open cycle gas turbine. Secondly, there is two stage internal combustion of coal in the open cycle engine. This implies turning the coal into producer gas and then burning the gas in the engine. Thirdly, there is the external combustion of coal in either an open on closed cycle engine.

Both the British Coal Utilisation Research Association and the Fuel Research Station are carrying out work on the best type of combustion chamber to be used for burning coal and have satisfactory chambers running.

In the two stage internal combustion engine it is attractive to make an integrated scheme, although this will require a lot of experimental work. A high temperature recuperator is required and a gas producer to operate at 6 atm. pressure. A pilot high pressure producer is now on test. This work is under the jurisdiction of the Coal Board, and the gas producer is being developed by the Incandescent Heat Co. and Joseph Lucas.

The burning of peat is also a possibility, as large quantities exist in the Scottish Highlands. This work is being undertaken by Ruston & Hornsby and John Brown.

If attempts to gasify coal in the ground prove successful, there will be another application of the gas turbine, in order to turn this gas into power.

There is a further interesting experiment which is being tried by the Coal Board, which is to use the firedamp (methane) which is at present discharged into the atmosphere from mining shafts. There is only a concentration of about 1% methane, which is, however, of the right order for the gas turbine. We need a high temperature valved-heat exchanger to pre-heat the air entering the combustion chamber, as it is too dilute to burn at ordinary temperatures.

Remembering, therefore, that gas turbines can now be run with efficiencies of around 34%, they will, as soon as the art of running on either coal or heavy oil is mastered, more than compete economically with steam turbines and diesels. It must not be forgotten that the gas turbine is in its infancy, and with only a few per cent. improvement in component efficiencies, and, say, 150° increase in maximum temperature, the simple type of engine will increase in efficiency from 24% to 34%, and compound engines from 30% to 40%.

Quite recently considerable attention has been focused on small gas turbines. These are, although low in efficiency, extremely small and light, and they are very attractive as standby sets, particularly as their simplicity will make them cheaper than high-speed diesels. They will not, for example, require any foundations, and can frequently be put in extremely small rooms, quite near people and other machinery, as there is freedom from vibration. Their maintenance is expected to be extremely light.

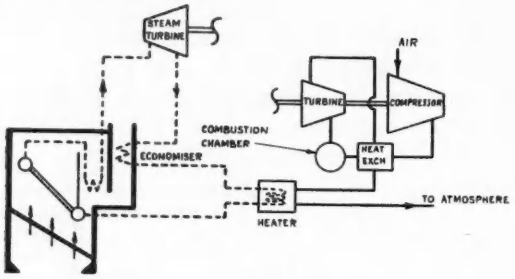

Fig. 1.

Apart from the main line of development mentioned above, there are several other very interesting projects. These mainly concern integrating the gas turbine into a particular industry in such a way that the heat content of the gas turbine exhaust is used, giving a very high overall thermal efficiency. Applications include sewage works, blast furnaces, power stations, and gasworks.

Application to Gasworks

The power requirements of gasworks have developed through various stages. Initially gas engines were used, or small steam engines taking their steam from several boilers often fired by solid fuel. With the increase in efficiency consciousness which has developed since the first world war, and the increase in internal electrical load, there has been a gradual change to more efficient power generation. There is now a growing tendency towards complete electrification, with all the electricity being supplied by one fairly large and efficient steam turbine.

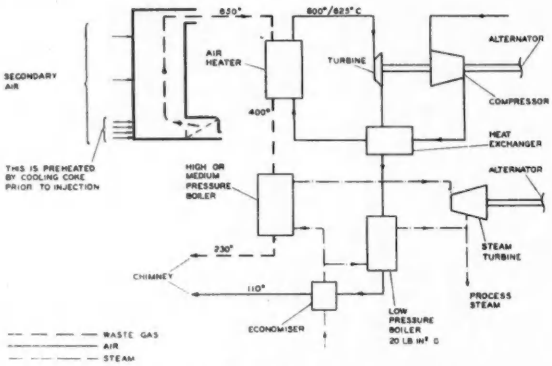

Fig. 2.—Layout for Continuous Vertical Retorts.

With the coming of the gas turbine, my firm has given a great deal of thought to see if it could be fitted into the gas industry and yield a further gain in efficiency. Most work has been done in connection with continuous vertical retorts, and after much careful thought we have come to the conclusion that the gas turbine is a good investment in some cases, particularly if there is a large internal electrical load and the retorts supplying the waste gas operate as base load plant throughout the year. To put it another way, the gas turbine results in a larger amount of electricity being generated from a given amount of waste gas, but as the Electricity Board will only pay about 0.4d. per unit, it is not always economical, bearing in mind the higher capital cost, to export any surplus to the works requirements to the grid.

If, however, the works load is high, and the gas turbine avoids the necessity for purchasing electricity at over 1d. per unit, then it can be an economic proposition. Each works has really to be considered on its own merits. In view of the tendency to close down small stations, and increase the size of large ones, giving them high compressor loads in order to meet the increased length of pipe lines, the gas turbine should come more into the picture in future years. It must be emphasised that the above conclusions are based upon the outputs obtainable with present long life gas turbines, and that as efficiency is increased by, for example, the ability of the turbine to accept higher temperatures, then so the picture will change.

Fig. 1 shows a typical layout for a continuous vertical retort plant in which the waste gases from the retorts are passed through a waste heat boiler which raises steam for use in a pass-out condensing turbine.

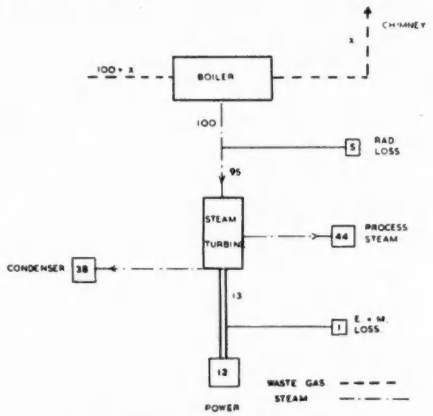

Fig. 3.—Waste Heat Recovery Scheme for Power and Process Steam (4,000 lb. per hour, 5 mill. works).

Fig. 2 shows a layout for a continuous vertical retort plant, but including a gas turbine. As will be seen, the heat contained in the waste gas between the temperatures 850° and approximately 400° is imparted to the air in the gas turbine cycle. This air first passes through a compressor, then to a heat exchanger, followed by the air heater, and is then expanded in a turbine, before again passing through the heat exchanger.

The waste gas, after passing through the air heater, can be used to raise medium or high pressure steam in an orthodox boiler, while the exhaust air from the turbine (after passing through the heat exchanger) still contains enough heat to raise a useful quantity of process steam at 20 lb. per sq. in. if it is passed through a low pressure boiler. The air can finally be passed through an economiser which will serve both boilers.

It is very difficult to generalise regarding the increase in power to be expected with the gas turbine cycle because each gasworks is different. One case has, however, been worked out, which is to some extent typical. It was a works producing 6 mill. cu.ft. of 500 C.V. gas per day, there being 875,000 cu.ft. per hour (N.T.P.) of waste gas from the retorts at 850°C. Process steam requirements were taken as 475 lb. per hour of high pressure steam (250 lb. per sq. in.) and 6,250 lb. per hour of low pressure steam (20 lb. per sq. in.). It was found that an ordinary steam turbine installation (250 lb. per sq. in., 700°F.) would produce 1,130 kW. Subtracting the fan power requirement we are left with 1,030 kW. The gas turbine alone (no power assumed to be produced from the steam raised in H.P. and L.P. boilers, which incidentally supply more than the process requirements) would produce 1,225 kW—*i.e.*, roughly a 20% increase in power. The percentage increase

(*Continued on p. 369*)

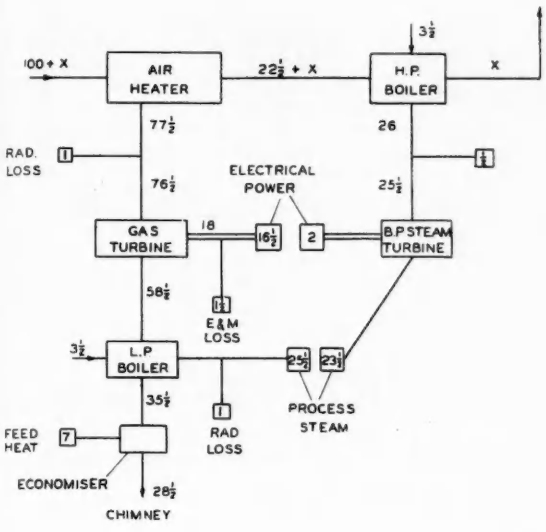

Fig. 4.—Heat Balance Chart (combined cycle).

would be greater if compared with a lower pressure steam installation. If at the same time the steam raised is passed through a mixed pressure pass-out steam turbine, then, still satisfying the above process steam requirements, 1,550 kW would be produced (an additional 325 kW from the steam turbine). Subtracting the fan power requirement, the net power output is 1,450 kW—*i.e.*, a 40% improvement over the all-steam cycle.

It is possible, in some works, to use existing H.P. waste heat boilers to raise steam, and also existing steam turbines. This is most attractive, because if new boilers and steam turbines have to be bought as well the initial capital cost tends to be rather high.

It might be possible to use 15% to 20% of the air from the gas turbine heat exchanger as primary air for the producers and thus effect a small saving in fuel consumption. The use of such hot air at 250°C. might, however, lead to excessive formation of clinker with consequent increase in carbon content of the pan ash and thus nullify the theoretical saving in fuel. An experiment of using hot primary air for the producers would seem well worth while.

Figs. 3 and 4 show how the heat available is used and lost in an all-steam cycle and a typical gas turbine cycle respectively. In this gas turbine cycle the steam from the H.P. boiler is passed through a back pressure steam turbine and it then joins the L.P. boiler stream and is used for process work. These diagrams help to show why a larger electrical output is obtained in the gas turbine scheme.

(Concluded on p. 371)

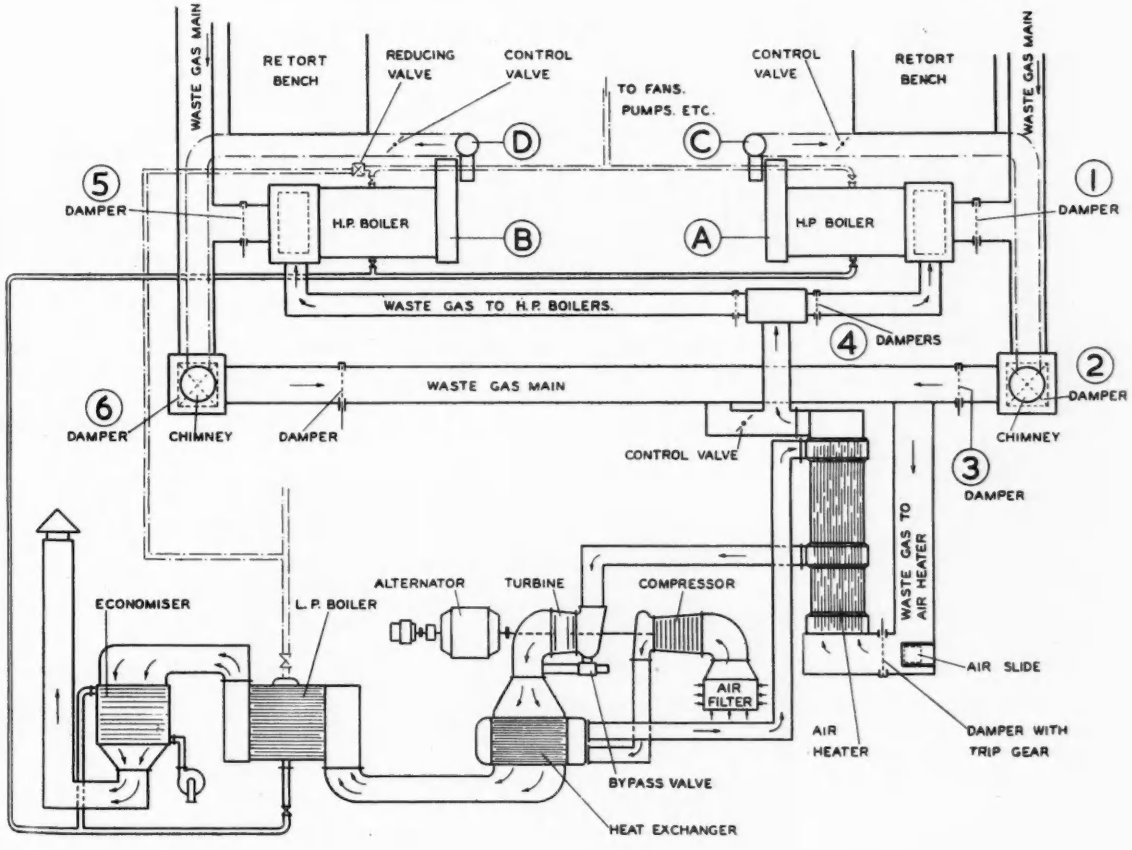

Fig. 5.—Waste Heat Gas Turbine in Gasworks.

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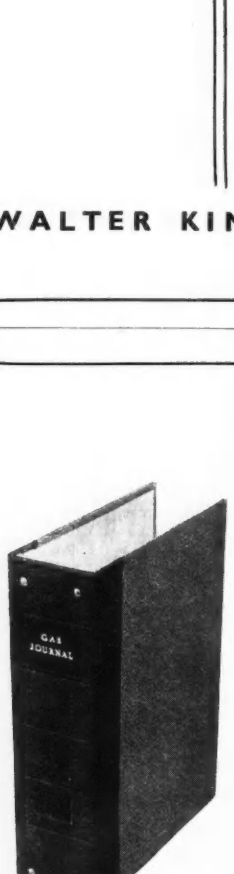

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One particular installation has been considered in considerable detail by the Woodall-Duckham Company and ourselves. A diagrammatic layout is shown in Fig. 5. It can be seen that the waste gas mains from the retorts can supply waste gas: (a) Directly to the main chimneys; (b) through dampers 1 and 5 to the H.P. boilers; or (c) through damper 3 to the air heater and then to the H.P. boilers. Air for the gas turbine enters the compressor through the filter, and then passes through the heat exchanger, the air heater, is expanded in the turbine, passes again through the heat exchanger and on to the L.P. boiler and the economiser which serves all the boilers. The H.P. boilers are already in existence, and so is the plant for using the steam. The actual gas turbine is low rated with a fairly low compression ratio of 4.25:1, and a modest turbine inlet temperature of 600°C. It has a separate work (or power) turbine.

Starting Procedure

The starting procedure for the gas turbine would be as follows: Let it be assumed for the moment that the waste gas from both retort benches is passing through the two waste heat boilers A and B. The boiler A will be disconnected from the system by closing damper 1, and the waste gases will be discharged to the atmosphere through the appropriate chimney by opening damper 2. The L.P. boiler will be brought up to temperature by live steam. The turbine will be motored up to its starting speed of approximately 2,000 r.p.m., thus circulating a small quantity of air throughout the air system. Dampers 3 and 4 will then be opened and the boiler fan C started. This will begin to draw waste gas from one bench, through the air heater, and the boiler A, and an increase of fan speed the turbine will become self-running. Further increase in the speed of fan C will cause the turbine to accelerate and will reduce the flow of waste gas in the main chimney. When this flow reaches zero the damper 2 may be shut, and the turbine is then running wholly on one bench. It is probable that before this state is reached it will have become necessary to parallel the alternator with the grid. The more sensitive control of the power turbine speed necessary for this will be effected by an automatically operated turbine by-pass valve. The second bench may now be brought into operation by a similar procedure—namely, the shut-off boiler B and the discharging of the waste gases by the main chimney, followed by the opening of the appropriate dampers and the speed-up of fan D. When the flow of gas in the second chimney is reduced to zero, the gas turbine will be on the maximum load corresponding to the waste gas flow. The gas turbine will be disconnected from the retorts by following the reverse procedure.

The draught on the retort setting will be controlled in the usual way by the fans C and D on the outlet from the H.P. boilers. The power output from the gas turbine will be controlled by the air heater bypass valve and the turbine bypass valve.

When running on load, and connected into the grid, the amount of load can be varied if desired by adjusting the opening of the air heater bypass valve. This will probably be done manually, and it will mean that more steam can be produced if required instead of putting electricity back into the grid. A rapid change of output can be effected by means of the turbine bypass valve. If, however, it is required in an emergency to operate alone and supply current direct to the gasworks, an immediate response to changes of load is required, and it is considered that this can again be effected by the turbine bypass valve, controlled through a servo-mechanism by a speed control governor driven from the power turbine shaft. The design of the system will be orthodox in that the speed of the power turbine and alternator will be kept constant at all loads and for sudden load changes. While the set is being controlled in this manner, the air heater bypass valve will be shut.

The set would have to be fitted with an emergency device in order to take care of such cases as:—

(*a*) A sudden electrical failure (removal of load).
(*b*) A sudden mechanical failure of the turbine—for example, oil pressure failure.
(*c*) The stalling of one of the boiler fans.

This can be effected by means of an overspeed trip on the power turbine which will stop the fans. A Klaxon automatically warns the operator to open the main chimney dampers.

It has become clear that only small increases in efficiency can be expected in the future from existing prime movers, steam turbines, diesel engines, etc. As, therefore, the gas turbine, although in its infancy, already has efficiencies comparable with steam boiler/turbine installations, it would seem to be worth while to spend time and money on its development. This is particularly true of the coal burning turbine, as thermal efficiency is very important nationally, and there will be a shortage of coal for many years to come, which will cost the country millions a year due to load shedding. In spite of the drawback that the gas turbine cannot yet burn coal or heavy fuel, it has already carved out for itself a limited field of application as a light weight, peak load, and standby engine. It must not be forgotten that the building required to house a gas turbine is very much smaller than that required for a boiler/steam turbine installation, which, incidentally, often represents a considerable proportion of the total cost; also that the maintenance costs of a gas turbine will be much lower than those of a diesel.

(A report of the discussion will be published in a subsequent issue.)

DETERMINATION OF POLYNUCLEAR HYDROCARBONS

THE following (from *Chemistry and Industry*, 1951, pp. 1066-1067) is a summary by Philip Wedgwood and R. L. Cooper (Sir John Cass College and the St. Albans Laboratory, Watford Division, Eastern Gas Board) of a thesis on 'The Detection and Determination of Small Quantities of Polynuclear Hydrocarbons by a Combination of Chromatography and Absorption Spectroscopy.'

During the past year we have developed the combination of chromatography and absorption spectroscopy for the examination of gasworks and sewage effluents, petroleum, and tar oils and have found it to be a powerful technique that can be applied to many other analytical problems.

For our purpose a chloroform solution or extract of the sample was extracted with both acid and alkali to remove basic and acidic substances respectively and then carefully evaporated to dryness. The residue was then dissolved in spectroscopically pure *cyclo*hexane, passed through an alumina column (5 cm. × 1 cm.) and eluted with *cyxlo*hexane in which some benzene was present. Absorption spectra of successive filtrate were recorded by means of a 'Unicam' spectrophotometer and compared with those of pure compounds. For the testing of small quantities of oils no acid/alkali extraction was necessary and short columns (1½ cm. × 1 cm.) were found effective. In this way it has been possible to detect in the effluent from a concentrated ammonia liquor plant pyrene, fluoranthene, 1 : 2 benzanthracene, 3 : 4 benzpyrene, perylene, anthanthrene, and other substances not identified with certainty. In the solid matter also which separated on standing from such effluent were found pyrene, fluoranthene, benzpyrene, perylene, anthanthrene.

The solid 'humus' separated from treated sewage works effluents has also been found to contain complex hydrocarbons including pyrene, fluoranthene, 1 : 2 benzanthracene, 3 : 4-benzpyrene, chlorophylls, and other substances which are probably carotenoids. It was interesting to find that such aromatic hydrocarbons as these were present whether or not gasworks effluents were discharged to the sewers. Pyrene and fluoranthene have been detected even in the aqueous effluents from sewage works and our further work is being directed towards quantitative estimation.

The presence of pyrene, fluoranthene, benzpyrene, and anthanthrene has been demonstrated in the exhaust gases from a motor car engine. Analysis of a mixture of hydrocarbons synthesised by passing town gas over a catalyst at an elevated temperature revealed the presence of naphthalene, anthracene, pyrene, fluoranthene, benzpyrene, and other compounds with well defined spectra of the hydrocarbon type.

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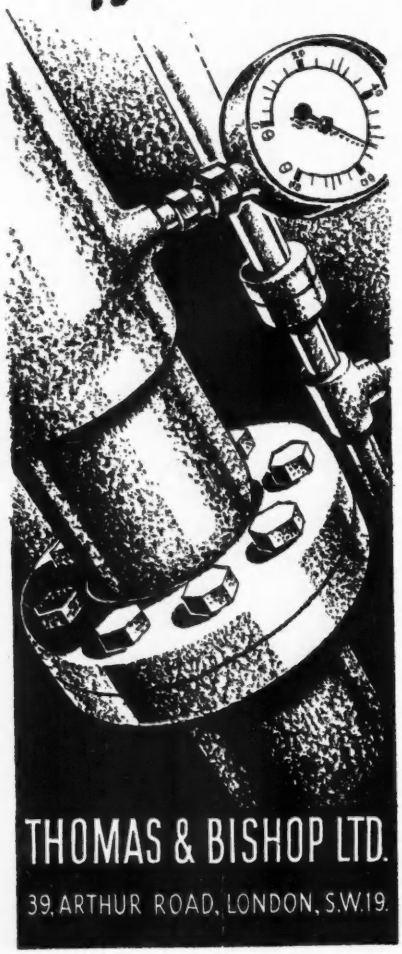

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Gas for Middlesbrough Housing Estates

STEADY progress is being maintained on the laying of gas mains to all new housing estates in the Middlesbrough Division of the Northern Gas Board and despite the worsening position in regard to the delivery of pipes, Mr. J. Pallister, Divisional General Manager, was able to give the Divisional Consumer Committee the re-assuring report: 'We have been able to keep ahead of all housing developments.' Addressing the January meeting of the Committee, Mr. Pallister reported that good supplies of gas had been maintained throughout the Division during the previous six months and as pipes became available they were gradually improving conditions in the few localities of poor supplies.

Mr. Pallister told the Committee that the Middlesbrough division is now connected through to the Stockton works and in emergency it would now be possible to feed gas from the Cannon Street holder station at Middlesbrough to the Stockton distribution system. It is hoped that the installation of boosting plant will be completed both at Stockton and Middlesbrough this year when it will be possible to pump gas in either direction from holder to holder.

A new gas dehydration plant has recently been put into operation at the Middlesbrough works and this is already proving its worth in that the mains on the district are now all dry and there is no trouble with stoppages due to the presence of water. It is also anticipated that corrosion troubles will be materially reduced as time goes on due to the supply of dry gas.

Turning to the South Bank unit, Mr. Pallister stated that the output of gas there had shown a slight increase compared with the corresponding six months of 1950. The unit continued to receive supplies from Middlesbrough and was still being enabled to operate with one gas-making plant instead of two, resulting in considerable financial saving. Work, said Mr. Pallister, was proceeding at present on large gas main alterations in the works of Smith's Dock Co., Ltd., which would finally result in gas consumption at the firm being substantially increased.

In the case of Redcar output during the last six months of 1951 had also shown a slight increase. Work was proceeding on the installation of new boosting plant at the Redcar works for pumping gas to Saltburn, Skelton, and Guisborough.

'The 18 in. main which is being laid from Wilton to the Redcar works is nearing completion,' continued Mr. Pallister. 'This main will provide a direct link between Middlesbrough and Redcar and when completed the three major works in the division—Middlesbrough, South Bank and Redcar—will be linked together. This is a step towards the completion of the grid scheme which will finally result in the manufacture of gas for the whole division being concentrated at the Middlesbrough and Cleveland works.'

Pointing out that the sales of appliances were still restricted by the supply position, Mr. Pallister said that they were receiving little more than sufficient appliances to meet the needs of new houses.

Alderman Joseph Hoy, Chairman of the Consultative Council, said he believed that a substantial contribution to the solution of the problem could be made by both industrial and domestic consumers. 'The solution to the fuel problem,' he said, 'lies in economy in the use of coal for internal consumption. Many tons of coal are wasted in industry annually and this is waste which might be eliminated by better management. The Ridley Committee appointed by the Ministry of Fuel and Power has been asked to make recommendations on the wider aspect of fuel policy and probably it will concentrate on trying to put the three national fuel industries in their correct spheres of use. At the present time when each works independently of the other electricity is often used in spheres where it might be more economical for gas to be used.'

Publications Received

THE National Smoke Abatement Society has published the 'Proceedings of the Blackpool Conference, 1951.' The volume includes the Des Voeux Memorial Lecture by Dr. J. Bronowski, on 'Power and Waste in their Social Setting,' the Presidential Address by Dame Vera Laughton Mathews, and 13 other papers that made up the three other sessions of the conference. The first group of five papers is on 'The Smokeless Operation of Small Steam Raising Plant'; the second 'Policies for the Prevention of Industrial Air Pollution' (with contributions on the collieries, gas, electricity, iron and steel, and cement); and the third is on the domestic problem, under the title of 'Smoke Prevention in the Home—the Woman's Viewpoint.'

The volume contains much interesting and authoritative information on many aspects of the twin problems of smoke prevention and fuel efficiency, and will make an important addition to the growing literature on these subjects. Copies are available from the Society at Chandos House, Buckingham Gate, S.W.1; price 7s. 6d.

Welding Research, Vol. 5, No. 5, October, 1951 (British Welding Research Association, 29, Park Crescent, W.1; price 5s.) contains a report by R. Weck, PH.D., on 'Fatigue Strength of Panels with Welded Angle Stiffeners.' Fatigue tests were carried out by the resonance method and the effectiveness of several different types of reinforcing straps was investigated with the object of finding out whether the fatigue strength of butt welds can be improved by the use of such straps.

* * *

'*Principles of Lighting*' is the title of a book by W. R. Stevens, B.SC., M.I.E.E., F.I.E.S., Research Laboratories, General Electric Co., Ltd., published by Constable and Co., Ltd., 10, Orange Street, London, W.C.2, at 35s. It describes the principles underlying different types of lighting installation and exemplifies them by current good practice. The earlier chapters cover such matters at photometry and colorimetry, and the rest of the book deals with lighting method. It is designed to serve as a textbook for Section B of the Final Examination in Illuminating Engineering of the City and Guilds of London Institute.

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